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THE

Canadian Engineer

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The Canadian Engineer

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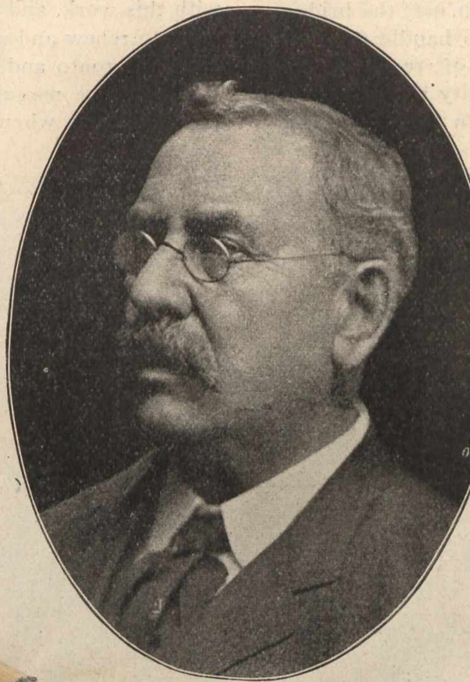
"We judge ourselves by what we feel capable of doing; but the world judges us by what we have already done."

Longfellow.



GRAHAM FRASER.
Pioneer in Canadian Iron and Steel Development.

Prince Consort is reported to have said, "If we want any work done of an unusual character, and send for an architect, he hesitates, debates, trifles; we send for an Engineer, and he does it." In December, 1903, the Dominion Iron and Steel Company, Sydney, Cape Breton, had reached a critical stage in its existence. Started in 1891 with bright hopes and prospects, the manufacturing career of this far-famed company had been checkmated at every move by serious obstacles—personal, material, financial; and, so far, had not been a paying business. The great railway project of the Grand Trunk Pacific, and proposed extensions of the C. P. R., and other lines in the far North-West, presented an alluring vision of trade in steel rails and rolling stock. The only works on British soil in North America, capable of supplying the demand, even partially, was the immense blast furnace and steel plant at Sydney. But the margin of inability to supply was so large, that it meant either the installation of a costly modern rail mill plant, or letting in the enemy. The former alternative was chosen. To achieve this, however, needed business judgment and Engineering insight of the highest order. With the time came the men. Mr. Frederick Nicholls straightened out the finances (see "The Canadian Engineer," November, 1905, p. 350); and Mr. Graham Fraser was called in (January 1, 1904), as director of works, and superintended the evolution of the splendid rail mill—designed to roll 1,000 tons per day—which was started up successfully in June, 1905, and which will be fully described and illustrated in our February issue. With the completion of this notable work, Mr. Fraser at 59, and after 30 years of strenuous Engineering feels like Longfellow's "Village Blacksmith," that having—

"Something attempted, something done,
He's earned a night's repose."

It is a fitting moment, therefore, to include him in our portrait gallery.

Graham Fraser was born in New Glasgow, Nova Scotia, in 1846. At sixteen he was apprenticed to the forge business in Providence, R.I., United States. After some experience in the shipyard at Maitland, N.S., he commenced business for himself at the age of 23, contracting to supply iron-work and galvanized material for the wooden ships then in vogue. This business flourished, hence five years later, he took into partnership Mr. G. F. McKay, and established the Hope Iron Works at New Glasgow; manufacturing railway spikes, springs, axles, etc., and doing a general forge business. After two steam hammers had been installed to meet increasing demands, the name of the firm was altered to that of Nova Scotia Forge Company. At the end of eleven years of prosperous work, the forge was transferred to Trenton, on the East River, Pictou, and so successful was this enterprise—owing to the enlarged facilities—that in 1882 the company was reorganized and incorporated as The Nova Scotia Steel and Forge Company. But expanding trade necessitated still further extensions, and branch steel works were founded at Ferrona, N.S. Finding that the high price and difficulty of getting raw material, was a serious handicap, Mr. Fraser once more reorganized the company, this time, under the title of The Nova Scotia Steel and Coal Company, and commenced operations on a large scale, opening out works at Sydney Mines, Cape Breton, where they have their own coal mines with a monthly output of 59,000 tons (October, 1905). Ore mines, railways, ships, blast furnace, 235 tons capacity per day; and 3 40-ton O. H. steel furnaces, all in full swing. The success which has crowned his thirty years' work, led to his selection as director of works of the Dominion Iron and Steel Company, with the result that this celebrated plant is now working successfully and on a paying basis. In his 60th year, Mr. Fraser retires for well-earned rest, and carries with him the esteem, goodwill, and high regard of all men who take an interest in the iron and steel development of the Dominion.

NOTABLE BRIDGE CONSTRUCTION IN ONTARIO

In the spring of 1905 the Canadian Pacific Railway awarded to the Hamilton Bridge Works Company, Limited, the contract to renew the deck plate girder spans, and to remove the towers of two steel viaducts on the main line of their railway, between Leaside and Agincourt, Ontario.

The work consisted of forty-five spans 60, 40 and 30 ft. in length, respectively; and the removing or strengthening of the towers was arranged by putting in heavy intermediate struts between those already in position, and doubling up the bracing.

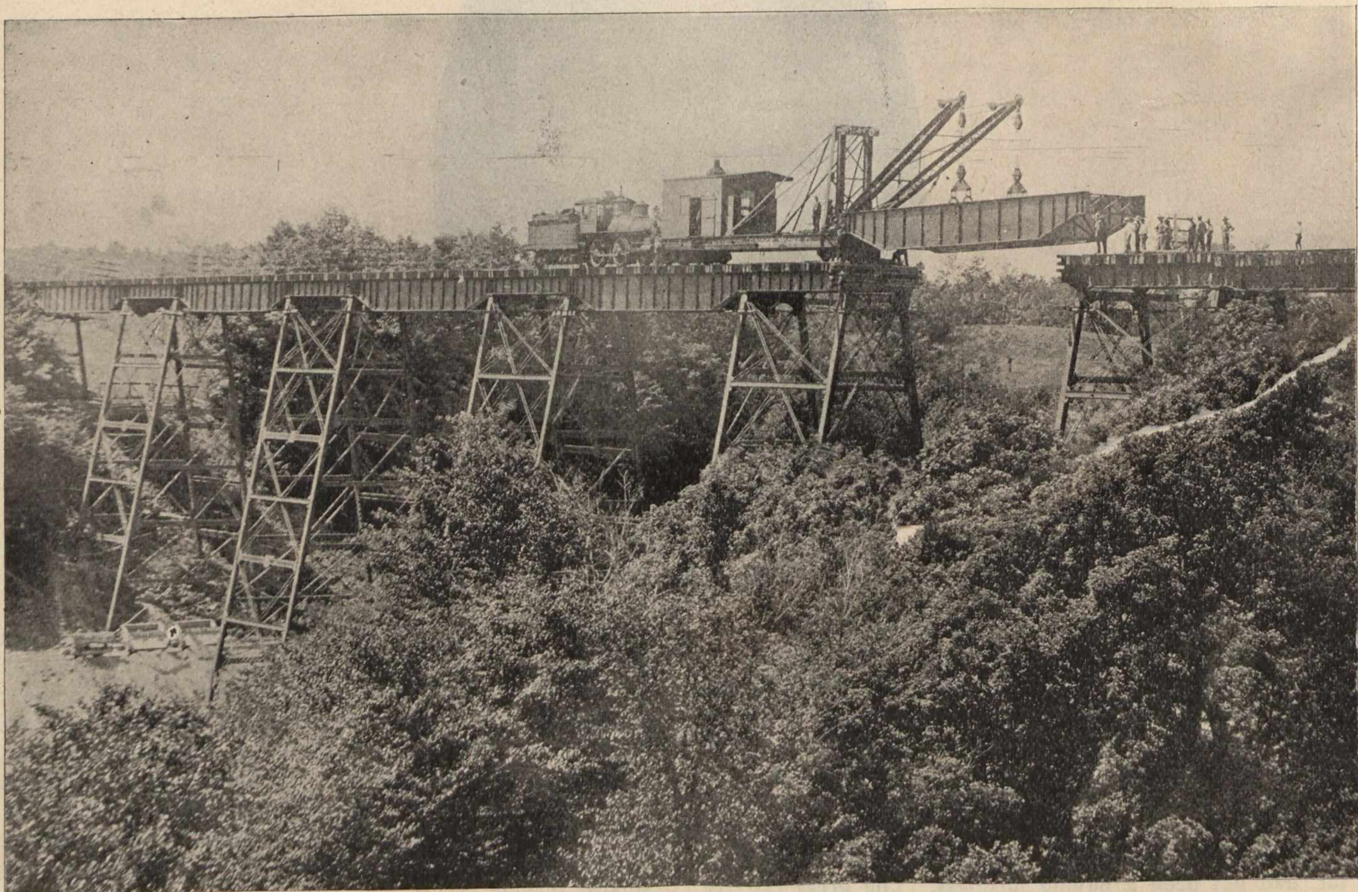
These viaducts were built about twenty years ago, when traffic was comparatively light. Owing, however, to the increased weight of the heavy engines now in use, the bridges were found to be of insufficient strength to handle the ordinary traffic, hence it was either a case of renewing the bridges entirely, or, to overcome the difficulty by reinforcing the towers and putting in new spans. An important consideration in connection with this work was the necessity of making the alterations and erecting the new parts so as to interfere as little as possible with the regular traffic on the line. Figs. 1 and 2 show how this was accomplished. It will be noted that the work of replacing the girders was entirely done with a self-propelling steel derrick car. The method of procedure was to first rivet up the new spans at one end of the bridge, frame all the ties, and in the case of the 30 and 40 ft. spans, to actually put them in place on the girder. The derrick car would then run out on the bridge, lift out the old span, bring it back and drop it to one side, then pick up the new span, carry it out to the proper place, and drop it into position. This mode of erection was so successfully carried out, that on several occasions 60, 40 and 30 ft. spans were put into place one after the other. On one occasion, two 40 and two 30 ft. spans were placed one after the other, and this work was done without one minute's interruption to the regular freight or passenger traffic on the line. This is the first instance in Canada, known to us, of such heavy girders being lifted in and out of place in this manner; false work being entirely done away with. The bridges are approximately 120 ft. above the bottom of the ravine, and extra precautions were taken during the progress of the work to avoid accidents, such as placing signal men at proper distances from each end of the bridge, etc.

The Canadian Pacific Railway expressed themselves as being exceedingly pleased with the operations in connection with this work, and have placed an order with the same company to renew and reinforce their other two trestles between North Toronto and Leaside Junction.

When the magnitude of this work, and success achieved is considered; when it is recollected that thousands of rivets in the towers had to be cut out and thousands of new holes drilled, and new rivets driven, it is astonishing that no accidents of even a minor nature took place, and certainly reflects great credit on the engineering staff of the company, and erection foremen in charge.

The work was under the supervision of W. F. Tye, chief engineer; C. N. Monserrat, bridge engineer; and A. L. Hertzburg, division engineer: all of the Canadian Pacific Railway Company.

This is undoubtedly one of the best pieces of erection work that has been carried out in Canada, and considering the difficulties, the success was very remarkable. Many railway engineers, who travelled from various parts of the country to see the work going on, have stated that the work was deserving of great credit.



The Donlands Viaduct, Near Toronto.

The first electric tramway built in Japan was the line, eight miles in length, which was opened in Kyoto in 1895. Since then other cities of importance have built electric tramways, and there are now seventeen companies with an aggregate capital of 36,000,000 yen ($18.000,000), whose lines already opened aggregate 120 miles, with 85 more building.

Up to 1840, there were no iron bridges in the U. S. A., except suspension bridges, in which iron links were used in the cables and suspenders, the floor system being of wood. The first bridge in America consisting of iron throughout was built in 1840 by Earl Trumbull over the Erie Canal, in the village of Frankfort, N.Y.

CANADA ON THE WORLD'S HIGHWAY

BY ALFRED J. ROEWADE,

Consulting Engineer, Civic Designer.

INTRODUCTORY.

Our Geographic Blinds.

To the fact that the earth is a spherical body, while on maps and charts it is represented as flat, is due many serious misconceptions and mistakes. The geographic comprehension, within a nation, may be on the highest possible plane, yet the popular conception be so clogged by bias centuries

Fig. 1.

Example of curious but common mistake; Globe with geographical lines from the Hemispherical Map.

old, that it is next to impossible, even for expert geographers, to disentangle themselves or take an unbiased view. Flat representations of a convex surface like that of the earth, in which all details are given with equal distinctness, in violation of the laws of perspective, must, as a matter of course, be distorted in some way; considerably, when a large part of the spherical body is shown, and most when the entire surface of the sphere is represented. This is a threadbare maxim, yet as soon as we try to delineate our geographic conceptions on paper, we are apt to err, because our ideas are wrapped in mysteries which we never take time to clear up by common sense processes.

The conventional method of imparting geographical knowledge, is that inherited from the sages of Babylonia: division of the earth's surface in meridians or degrees of longitude and latitude. The many general systems of projection—successively invented with a view of making flat reproductions of the earth's surface or the sea-bottom usable for practical purposes,—have gradually invested these lines, or network of lines, with an importance that threatens to outclass and subordinate the physical conditions or actual outlines of land and water in the mind of the student: whose idea of the earth's configuration is obscured by these bewildering technicalities, evolved in the course of four centuries or more. These lines, the meridians—which in reality are straight—as straight at least as a line can be on a curved surface—are represented in the various projectional systems as curved, while those representing the degrees of altitude, though really curved, are, at least in Mercator's system, made straight. Only equator, the base line of the graduation, is straight; all the other lines parallel to this are curved, the farther north or south the greater the curve. More or less droll examples of misunderstandings growing out of these conditions, and influencing the public mind, are very common. A conventional example is shown in Fig. 1.

Other examples are found in astronomical text-books: where a sort of perspective representation of the solar system, showing the earth in her various relative positions to the sun, together with pictures of other planets, are intended to convey the idea of globes by means of meridional lines from the hemispherical map. We may also now and then find maps accompanying scientific works or text-books, which claim to be complete maps, while they are nothing but partial tracings of larger maps; thus exhibiting the tracer's ignorance of the construction of a map with the central meridian as line of projection, i. e., straight.

Another consequence of the various commonly used systems of projecting is, that the outlining of land and water on the map is correct only in the middle, since by the "Mercator" system, distortion commences immediately you leave the centre, and increases the farther from the centre you go. Mercator's maps have practical value only in a general way, as an artificial means of viewing the lay-out of land and water on the surface of the globe: a sort of graphic index to the earth's geography. It is, however, harmful if used for any other practical purpose: if used for example as a navigator's guide. The navigator of the ocean—not sailing the equator, or straight north or south following a meridian—must, in order to indicate his course on a "Mercator" map, first draw a straight line from his home port to that of his destination. Yet as this seemingly straight line (the rhomb line), in reality is curved, and increasingly curved the farther from the equator; and as he would want to find the shortest way, he must subsequently construct a curved line of a curvature commensurate with the altitude,

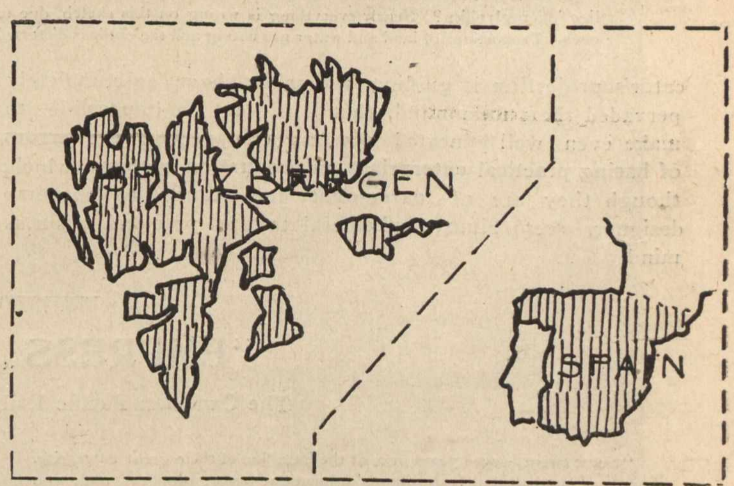


Fig. 2.

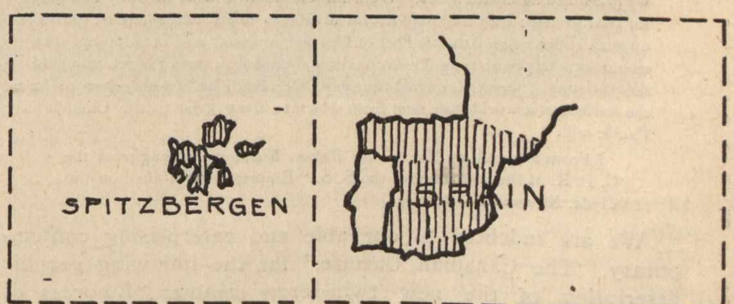


Fig. 3.

Figs. 2 and 3 show how proportions on the map are distorted by Mercator's projection. This is no extreme example. Spain is in both cases represented in same scale.

which is called "The Great Circle (sic) and represent the actually straight line, and this operation must be repeated for each run in a new direction. (See Fig. 3.).

During the infancy of navigation, when the sailor ventured on long trips across the ocean, he sailed direct north or south to the altitude of his destination, and then followed this altitude line. He did not, however, steer straight along the two sides of a triangle instead of its hypothenuse, but prolonged the longest side by following the curved altitude. It is not so bad nowadays, and if the above mentioned "rhomb" and "great circle" mysteries of the pilot house, were confined to this—preserving the glamour of captain and mate in the eyes of an ignorant crew—the clearing up of this puzzle would not concern us so seriously. But the trouble is, that these navigation fancies—which are by no means abandoned, or can be so, as long as Mercator's projection is guiding the sailor—have so completely pervaded the public mind, that it is next to impossible to make even well educated persons comprehend **the errors of basing practical enterprises on graduation systems,** which, though they are of paramount importance to the map designer, seem almost ephemeral to the practical business mind.

The way to a rational reform, to the casting aside of these time honored "geographic blinds," is a more common use of the globes, and the construction and publication of route charts and maps. Every ship should have a sea-globe, together with route charts for fixed lines, or contemplated trips. This would do away with "great circles and "rhomb lines" and thus relieve navigation of its cumbersome medieval appendix. If this is done, the general public will, as a matter of course, gradually follow suit, and take more sensible views with regard to transportation lines and settlement problems.

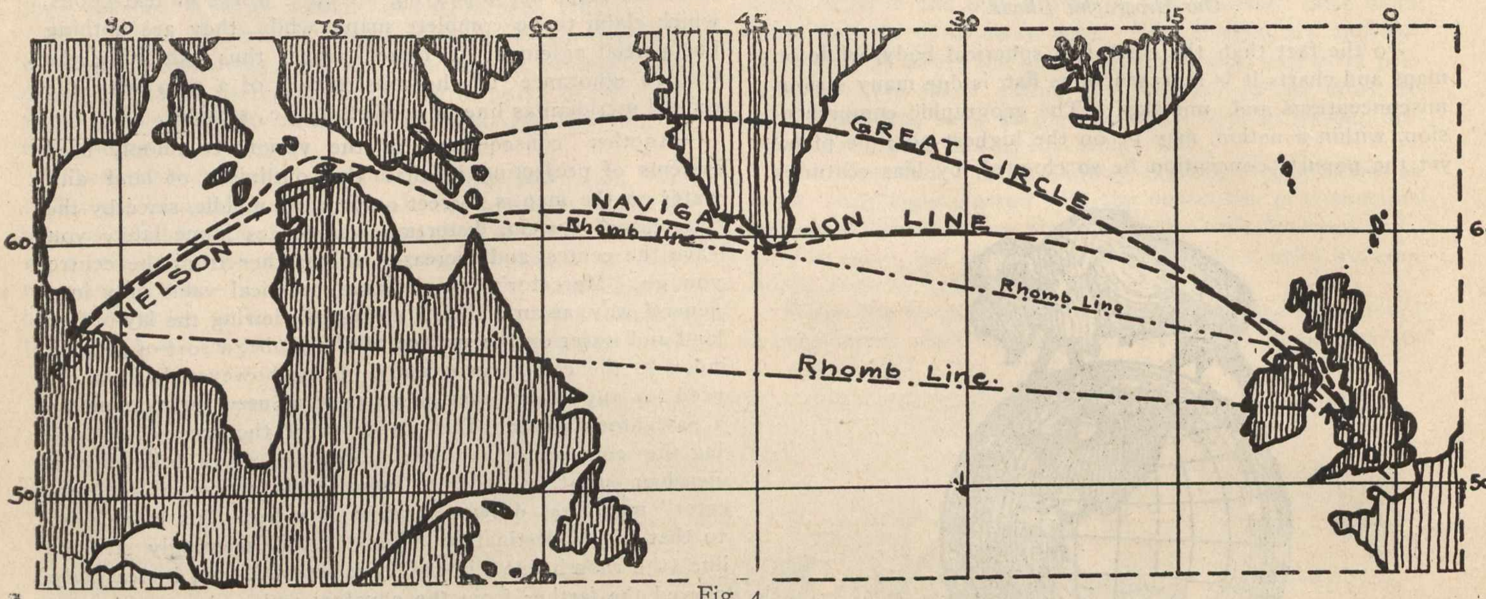


Fig. 4.

MAP SKETCH, MERCATOR'S PROJECTION; NAVIGATION LINE, PORT NELSON TO LIVERPOOL.

(Compare this sketch with Fig. 4 where the actual lines are shown. Is it a wonder if the seaman gets rattled by these "great circle" and "rhomb line" hieroglyphics? Nearly everything is wrong on this sketch, due to the projection system; curved lines mean straight ones, and straight, curved ones. Proportions of land and water are wrong and the outlines distorted.)

(Continued.)

"EMPRESS OF BRITAIN"

The Canadian Pacific Railway on the World's Highway.

"Some twenty-seven years ago, at the inception of their great enterprise, someone unmindful of Josh Billings' injunction 'never prophesy until you know,' had the temerity to predict that the Canadian Pacific Railway could not earn enough to pay for the grease on its wheels—not being an engineer we presumed he meant axles. Well, the Canadian Pacific Railway had paid for that grease; they had paid liberal dividends to its shareholders, picked up such trifles as an Atlantic fleet of fourteen vessels, and in addition they would soon have two magnificent passenger steamers, one of which they had the pleasure of seeing launched that day. It would, he hoped, prove to be the nucleus of a world-wide fleet from which to bring grist to the Canadian Pacific mill."

[From a speech by Mr. Archer Baker, European manager of the C. P. R. at the launching of the S. S. "Empress of Britain" on the Clyde, November 11th, 1905.]

We are indebted to our able and enterprising contemporary, "The Canadian Gazette," for the following graphic description of the new twin-screw steamer "Empress of Britain," which will next season take up her station in the Atlantic service of the Canadian Pacific Railway.

The world's most experienced travellers are readiest to admit that what the Canadian Pacific Railway does, it does well; and the advent of these ships can hardly fail to be among the events of the year. New and wonderful ships are, of course, no novelty; they are constantly claiming our attention. One no sooner drops into the background as yesterday's news than another claims notice under the latest intelligence. Yet there are substantial reasons why the coming of these "Empresses" should be expected to mark an epoch in world travel. A modern steamship of the first class is at any time an astounding creation, and it would seem practically impossible to carry forethought, in the provision of appliances for comfort and safety, a single step beyond what has already been done. But money rules, and the one with the longest purse—or, what comes to the same thing, the one who is prepared to dip most deeply into his purse—has the last word, or, to put it otherwise, can always go a step further. And in connection with its North Atlantic steamship service the Canadian Pacific Railway is exceptionally circumstanced. It has other and greater interests to consider, among them the paramount need of upholding the Canadian Pacific Railway name for providing something rather better than the best. Hence the expenditure of a few tens of thousands, or even hundreds of thousands, sterling on its North Atlantic fleet is of relatively trifling consequence when weighed in the balance against the maintenance of the Imperial status which the system has now acquired in Europe, America, the Far East, and Australasia.

The C.P.R. as Shipowners.

It is not generally remarked that the Canadian Pacific Railway owns a considerable amount of tonnage in the form of river and lake steamers, steamers performing coastal services on the Pacific and the original "Empresses" running between Vancouver and the Far East. That the company is no amateur in ship owning and management is evidenced by the reputation of its trans-Pacific service. On the Pacific the field was, so to say, unoccupied. The Canadian Pacific Railway merely stepped in, unleashing its beautiful "Empresses" and establishing a service of the highest known efficiency between Occident and Orient. On the North Atlantic the conditions were utterly dissimilar. Here, long established, were some of the premier steamship services of the world, redoubtable rivals not to be easily outshone. Why should the Canadian Pacific Railway have wished to take up a position among them, seeing how well the traffic was already provided for? The answer is that, admirably as the lines running between Europe and the Canadian ports performed the service, yet ever and anon the want of an independent Canadian Pacific Railway connection made itself felt. A great transcontinental railway with 11,000 miles of track, whose mission it is, among other things, to unite Great Britain with the Far East was bound sooner or later to add this last link. And the conditions being different another mode of procedure had to be adopted. Instead of at once proceeding to build a North Atlantic fleet of "Empresses," an existing fleet, not unworthy to carry the Canadian Pacific Railway flag was acquired, and with these steamers the first steps were taken. Armed with a thorough knowledge of the conditions and requirements of the North Atlantic traffic, the Canadian Pacific Railway is now determined to shoot ahead, and is having built at the famous Fairfield Yard on the Clyde, the birthplace of so many trans-Atlantic greyhounds, two "Empresses," the pioneers of a splendid fleet, to carry its passengers across the nearer ocean.

The C. P. R. and its Passengers.

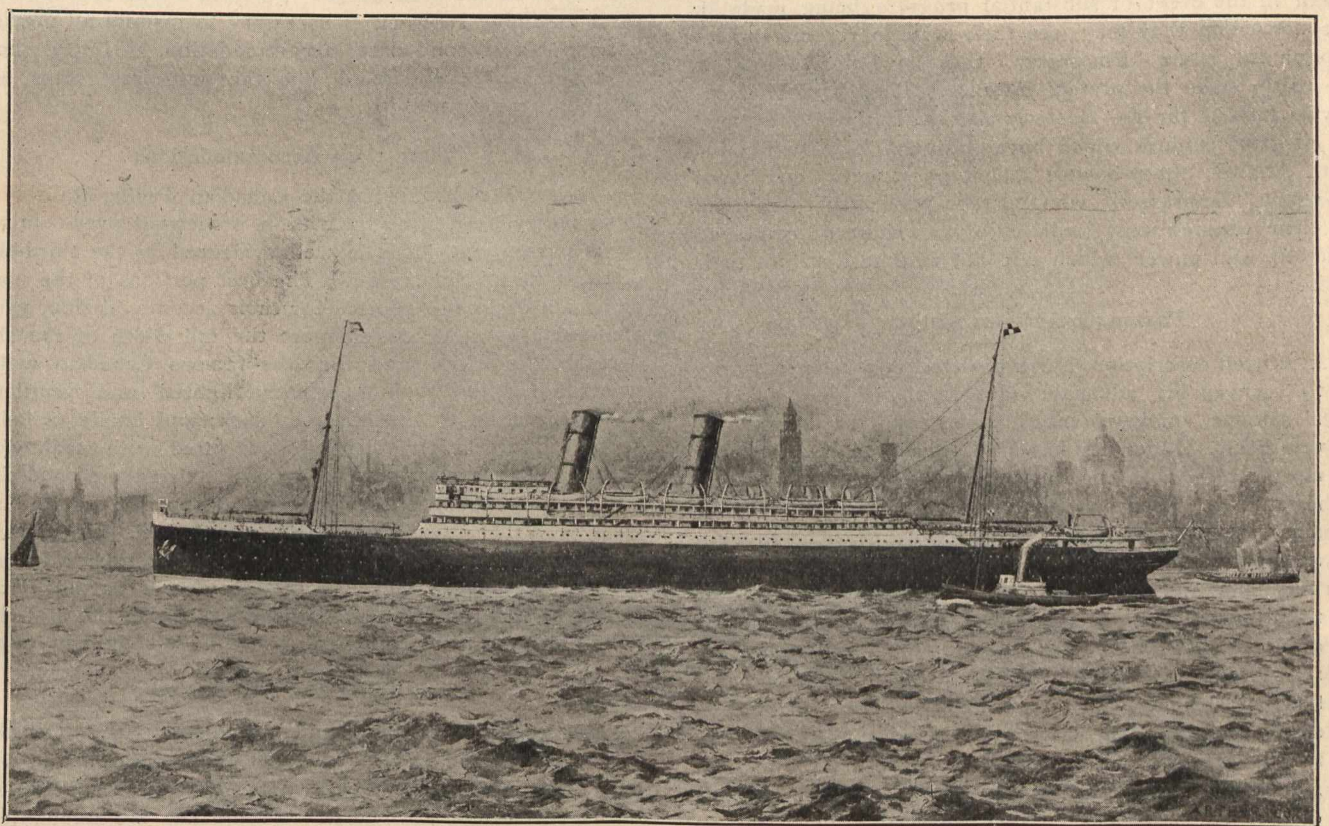
It must be borne in mind, too, that the relationship of the Canadian Pacific Railway to its passengers is exceptional. To a natural concern for their comfort and welfare is added the incentive of the other considerations already mentioned, and there is still another and very weighty consideration. A large percentage of all three classes of passengers are prospective valuable supporters, as purchasers of land, or shippers of produce; in many instances as both. The great object of the Canadian Pacific Railway, then, is, and must always be, to fill its passengers with high notions of Canada and all things Canadian, including the means of communication. It follows that nothing which recent progress in science and art has placed at the naval architect's command, nothing which money can buy, will be spared in making the new "Empresses" worthy to uphold the reputation of the great Imperial body whose house flag they will fly.

Size and Appearance of the New "Empresses."

In the matter of size, also, the new steamers will represent something beyond the highest point hitherto touched in connection with the ocean passage to the Dominion. Their registered tonnage will be 14,500 tons. Externally they will present an impressive and graceful appearance—the enormous hull with its soaring white central structure, surmounted by two great funnels, possessing beautiful outlines at the sharp stem and elliptical stern. The actual measurements are:—Length, 550 feet: breadth, 65 feet; and depth to upper deck, 40 feet. To possess a more vivid picture of what these dimensions imply, it is only necessary to pace out the distances of length and breadth, and then count the rows of brickwork on the front of a house, taking 120 rows for the 40 feet in height to the upper deck, and adding a second 120 rows for the promenade and boat decks and their superstructures. The untrained eye will probably not be able to keep count of so many rows, but it can be easily noted how many rows go to a storey, and how many storeys would be needed to make up the 240 rows. Then on the ground paced out raise an imaginary edifice of this altitude, and you will have a tolerably accurate conception of what these new "Empresses" will be in bulk as structures.

The Hulls—No Rolling.

The hulls are of the best British steel, with bottom and topsides hydraulic riveted, which technical expression means that the rivets employed are too stout to be secured by mere human arms. Another interesting feature about the hulls is that they will have deep V-shaped bilge keels to prevent rolling. Here again is material for an interesting calculation. The sides of a ship are practically smooth, and offer no resistance to the rolling tendency, which is only counteracted by the metacentric gravity, striving to keep the ship upright. The bilge keels will altogether represent an area of over 100 square yards, and, as a moment's reflection will show, act both upwards and downwards. Imagine the force that would be required to thrust a shield equal in area to the floor of two large rooms broadside through the water. Passengers might almost aspire to playing a game of billiards on board. Space precludes any attempt to enumerate the extensive precautions to secure safety, such as a double bottom, water-tight bulkheads, etc. One comparatively small appliance, however, which has been much talked of lately may be mentioned. It is for receiving sound signals through the water. At certain important points on the coast of Canada and in the St. Lawrence River submarine bells have been placed, which in thick or foggy weather are sounded automatically by pneumatic pressure. In the bow of



The "Empress of Britain."

the new "Empresses" on the port and starboard sides transmitters will be fitted, and connected by wires with a telephone box in the navigation room, and by listening at the telephone the officer in charge will hear these warning bells when they are still miles away, and be able to fix the position of his ship, no matter what may be the state of the weather.

Engines and Boilers.

Of equal importance with the hulls, and of far greater costliness, are the boilers and engines. For those with technical knowledge and interests it may be mentioned that the steam pressure in the boilers will be 220 lbs. to the square inch, and that the furnaces will be fitted with Howden's system of forced draught. The engines will be quadruple expansion of the direct-acting reciprocal type, a distinct set driving each of the twin propellers. They will be balanced on the Yarrow, Schlick, and Tweedy system, so as to obviate all vibration, and will be of sufficient horse-power to maintain an average speed of 18 knots an hour at sea, with two knots in reserve to maintain the Canadian Pacific Railway reputation for punctual running. In the opinion of the company's engineers, the turbine engine has not yet reached the stage when it can be relied upon to the same extent as the reciprocating engine for large steamers, and therefore, though in the event of substantial progress being made in its construction they may see their way to recommend its adoption for future "Empresses," they have not thought it wise to do so in the present instance. The Fairfield Company is famous for the masterly workmanship of the many sets of giant engines which have brought fame to notable North Atlantic "grey-hounds," and passengers on board these new "Empresses" who may be privileged to descend into their engine-rooms will enjoy a sight of combined symmetry and power which will not fade easily from their minds.

Passenger Accommodation.

A written description, however detailed, must necessarily fail to convey an adequate idea of the dining saloons, ladies' saloons, smoke-rooms, libraries, and music-rooms of the new boats. Ingenuity has surpassed itself in contriving the most comfortable and cosy shape and proportions, and at the same time securing the most favorable position. The accommodation of each class has, in its degree, been thought out with patient care, with the result that there are many improvements and changes for which travellers in these ships will owe a debt of gratitude to the Canadian Pacific Railway technical officials. The state-rooms and cabins are models of comfort and convenience, with the all-important questions of a right temperature and sufficient ventilation settled by the aid of the latest mechanical appliances.

In all there are eight decks; the uppermost, the boat deck, does not, however, concern passengers. For them it is a distant land where the ship's officers reside, and to which firemen and oilers ascend by ways invisible to gain their "playground." The upper promenade deck is the passengers' uppermost deck. It is completely covered in and protected in all weathers by the boat deck. Around the central deckhouse is the finest strolling ground on board and the best position for deck chairs. Within this great central structure is the music room, and also the entrance to the grand staircase and a number of fine state rooms, resplendent with beautiful woods, silks, and tapestry. The first-class passenger accommodation generally presents interesting and unconventional features. It is distributed over the choicest parts of the two promenade decks and the shelter deck. The disposition of the various public rooms is something of a departure, and represents the acme of comfort and convenience. In the placing and planning of these rooms the keynote is accessibility and cosiness, while everywhere there is ample light and perfect ventilation. In the matter of decoration, the treatment is bold and original, culminating in the music room, which, with its dome, suggests a Chapterhouse in Westminster Abbey, fitted with snug recesses and a cheery fireplace. The state rooms are of all kinds, and include some en suite with private bath rooms.

The lower promenade deck, unlike those above it, which do not extend beyond the central deck-house, runs right aft to the stern. Here amidships is the café, and adjoining it the first-class smoking-room with verandahs, so that passengers may smoke sheltered in the open if they so desire, and more special state rooms.

Next comes the shelter deck, extending from stem to stern. Right amidships is the first-class dining saloon, a splendid apartment with seating accommodation for about 250 persons. Among its novel and attractive features this saloon is remarkable for an arrangement of small horse-shoe-shaped tables to seat five, screened off to a sufficient height, and suggestive of delightful little lunch and dinner parties. Adjoining it forward, is the first-class children's dining saloon with its own separate pantry and service room.

Second-class Accommodation.

The second-class accommodation is also on the shelter deck abaft the first-class. The dining saloon is a spacious apartment extending the full width of the ship, and handsomely fitted in rich mahogany. Adjoining it is the second-class social hall, and adjoining this again is the second-class smoking-room. The second-class children's nursery is on the deck below. To form a true conception of these assembly rooms it is necessary to dismiss all previous notions of second-class accommodation. Lofty, light, roomy, they are appointed, like the first-class rooms with ungrudging elegance.

Third-class Accommodation.

It has been said that the Canadian Pacific Railway is, from policy as well as inclination, somewhat over-indulgent to its passengers. This is well evidenced in the third-class of these new "Empresses." The best portions of the upper and main decks are allotted for their accommodation, which includes a spacious dining-room the full width of the ship, decorated in white and with the famous Canadian maple-wood; a smoking-room, perfectly lighted and ventilated, opening out on to the covered deck; and finally, a ladies' room comfortably upholstered and fitted with mahogany. It has become a commonplace to assert that the second-class on board such and such a steamer is superior to the first-class of earlier days. It is quite a pardonable exaggeration, if it be at all beyond the truth, to say that third-class passengers will enjoy on board these new Canadian Pacific Railway ships comforts and indulgences which the first-class of not so very many years ago would have sought in vain.

The Table and Attendance.

As regards catering and attendance, the Canadian Pacific Railway officials have gained their experience in what is, perhaps, the best school, viz., the East. Sea appetite and boisterous democratic ideas of equality are undoubtedly fine things, yet we know that the one is not always present, and the other seems not unfrequently out of place at sea. On board the "Empresses" on the Pacific the menus are drawn up to tempt the most fastidious, and the service is prompt and intelligent. It may not be advisable to bring the patient Chinamen on to the North Atlantic, but it may be relied upon that on board the new "Empresses" these two all-important departments will be kept at the highest state of efficiency.

—The drill frequently penetrates hundreds of feet of solid salt in drilling wells for petroleum. The salt is often as clear as glass, as hard as rock and is frequently interstratified with shale, as is frequently the case with coal. In the region where there is a stratum of salt above the petroleum there is often salt water in the petroleum stratum. Especially is this the case where the material between the surface and the oil stratum is mainly limestone. The latter material, being very unyielding, its cleavage allows an easy access of water, often to a great depth; while clayey shales, being more plastic, often exclude all water from penetrating more than a hundred feet or so from the surface.

SMOKE PREVENTION

By the Editor.

Municipalities everywhere are beginning to enforce regulations with regard to the smoke nuisance: and rightly so too; for the evidence is overwhelming that the emission of black smoke from boiler chimneys can be prevented, without financial loss.

Among the appliances on the market, there is one—the Meldrum furnace—which is little known in Canada, but which is so practically effective as a smoke preventer, and at the same time suc' a fuel-saver, that its failure to secure general adoption in this country, can only be due to a lack of advertising enterprise on the part of the English inventor and manufacturer.

The phenomenal success achieved by this furnace is the best proof of its intrinsic value. In Europe 11,000 are in operation, representing in steam production considerably over **one million horse-power.**

The essential features of the invention are illustrated in Fig. 1.

As shown, the ashpits are enclosed by a cast-iron plate, fitting air tight and provided with a door, also fitting air tight, for removing the fine ash falling through the grate. Two steam jet blowers* are provided for each furnace, located within the ashpit immediately underneath the grate, and fitted to the ashpit front plate. Steam—superheated and perfectly dried—is supplied to the blowers in a very simple and ingenious manner; the air blast, and resulting combustion being regulated at will by a common steam valve. The grate bars (Figs. 2 and 3) are made interlocking to prevent displacement, the air spaces being about 1-16-in. wide, to prevent anything but the finest dust from falling through. The action of the steam and air on the bars prevents clinker adhering; the bars consequently last three or four times as long as ordinary bars with natural draught.

Noiseless.

A special claim set up for the steam jet blowers is that they are the quietest yet produced; a manifest advantage, since an irritating, ear-splitting noise has hitherto been a serious objection to this type of forced draught apparatus.

[* A common objection to jet blowers is that they are wasteful, and that the higher rate of evaporation is counterbalanced by the steam used by the blowers. The reply is that these blowers have been tested down to 2½% of the steam raised. Against this, the "Meldrum" furnace frequently effects a saving of 20 to 25% in cost of steam raising, when suitable cheaper fuel is obtainable.—Editor.]

Burns Low-class Fuels.

The greatest economy, however, is the adaptability of this furnace for the burning of inferior fuels. Until recently, large quantities of small fuel—coal dust from collieries and coke dust from gasworks—were considered as waste products, and sold for a nominal sum for special manufacturing processes, or stacked in waste hills, sometimes containing hundreds of thousands of tons. This refuse material is of like composition to the larger coal and coke, and though containing more ash, is mainly combustible. Each pound of breeze or coke dust—containing 20 per cent. moisture and 15 per cent. incombustible, will evaporate about 6½ lbs. water. The difficulty in utilizing coal and coke dust with natural draught consists in the fact that the finely granulated particles lie so close together that the air fails to penetrate thoroughly, hence the combustion is too sluggish to be of any use. But as soon as air at considerable pressure is applied to the underside of the grate, the fire wakens up as by magic, and what before was a dull red mass becomes a dazzling white fire. This is exactly what the "Meldrum" blower does, and the pressure does not extend further than the ashpit and through the fuel, which is just the place required to effect perfect combustion and a high temperature flame. After passing over the bridge, the flame and hot gases travel through the boiler flues or between the tubes, at the ordinary rate of chimney draught. This furnace will burn to advantage any kind of rubbish with carbon contents: breeze, ashpit refuse, ashes from puddling and heating furnaces, gas producers, retorts, etc. During the last great coal strike in England one of the largest city gasworks ran their power plant successfully by means of rubbish and "Meldrum" furnaces after their stock of coal was exhausted.

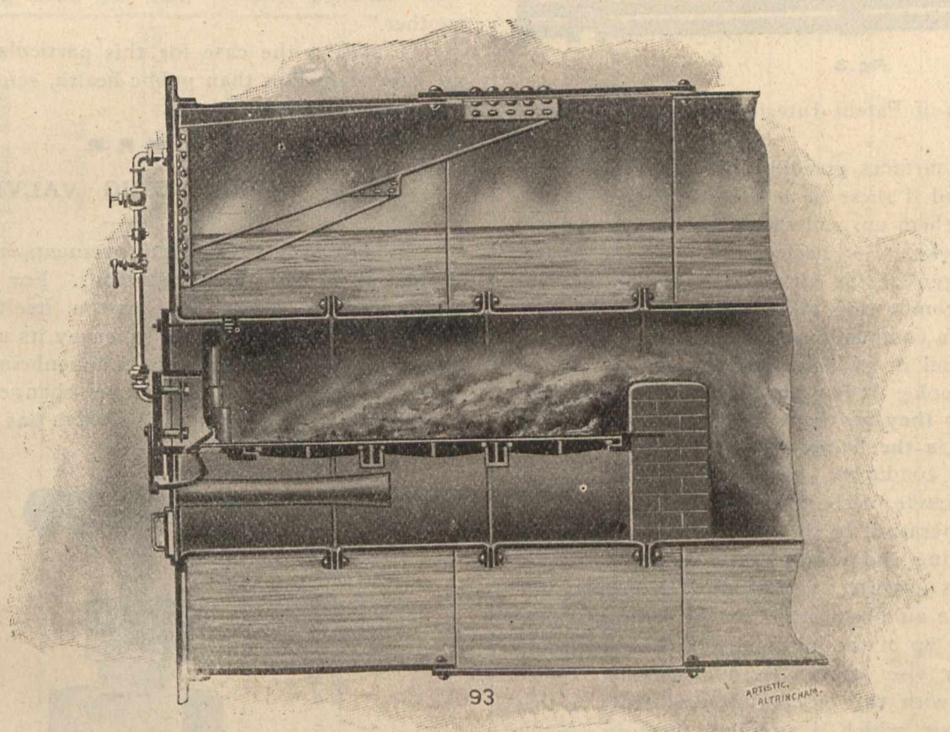


Fig. 1.—Longitudinal Section Through Furnace.

Forced Draught.

A distinction should be made between **forcing the fire,** and forcing the boiler. All small, close lying fuel burns slowly with ordinary natural draught. Assisted draught as applied to this material may be considered as **forcing the fire.** Where it is desired to force the boiler—by means of this furnace—the rate of combustion may be as high as 40 lbs. per sq. ft. of grate, and the evaporation per sq. ft. of heating surface up to 10 lbs. In electric light works, paper mills, breweries, laundries, and wherever large quantities of steam are often required suddenly, this apparatus with its emergency capabilities is especially advantageous: since the rate of combustion can be increased to much beyond what chimney draught can possibly accomplish: inasmuch as the whole air supply is under absolute control so that the fire may be forced or slackened at will, and this, entirely independent of atmospheric condition.

Smoke Prevention.

True anthracite coal will not produce smoke in any furnace. No boiler furnace yet invented will absolutely prevent the production of black smoke if bituminous coal is used. But owing to its scientific construction, the "Meldrum" furnace is probably the most perfect apparatus yet devised for effecting the complete combustion of bituminous coal before it reaches the comparatively cold surface of the water tubes

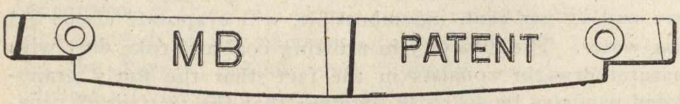


FIG. 2

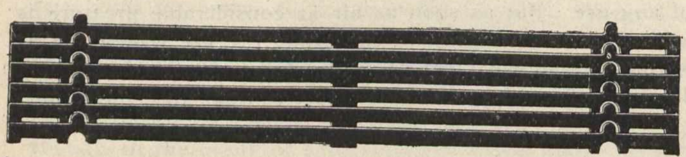


FIG. 3

Elevation and Plan of Patent Interlocking Grate Bars.

or flues. Cool boiler surfaces greedily absorb the heat from hydrocarbon gases, and if these be half-consumed, will, in a curious manner, split them up, and throw out carbon or soot —hence the black smoke. For perfect union of the hydrocarbon with the oxygen of the air, it is essential that the chamber where this combustion takes place should be at a high temperature. In a combustion chamber of low temperature, the richer the fuel in hydrocarbon, the greater will be the intensity of the smoke. **It is a peculiarity of hydrocarbon gases, that the hotter they are kept, the more quickly they burn and the shorter is the flame.** The "Meldrum" furnace admirably fulfills this condition; since not only is the enclosed ashpit and underside of the fuel bed always kept hot—due to the high temperature of the injected steam; but if (immediately after firing and raking) any of the hydrocarbon in the new fuel is imperfectly consumed by combustion with the oxygen in the air blast, aided by the hydrogen generated by the splitting up of the burnt steam, these half-consumed gases—as they rise above the incandescent fuel—straightway combine with the oxygen derived from a thin current of additional air, which is admitted through a valve opened automatically by the closing of the furnace door. In an intense secondary heat zone, therefore, and in the way described, is effected the complete combustion of the distilled gases. After distillation ceases—when secondary air is no longer needed—the valve is closed, and the generation of heat takes place by forced draught only, with a degree of efficiency altogether unique. Black smoke from the ascending flame there is none, since all the carbon is consumed by

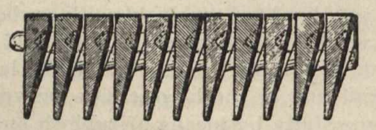


Fig. 4

Cross Section of Grate Bars.

complete combustion of the fuel. Authentic records show, that by the introduction of this furnace, some notorious chimneys have been practically freed from smoke. In one case where six large boilers deliver the waste gases into a chimney 2 feet 6 in. square, and burning from 120 to 150 tons of coal per week, continuous observations were taken for two weeks, and the total dense smoke readings averaged only thirty seconds per day.

Application to Metallurgical Furnaces.

One reason why there has not been a more vigorous campaign against the smoke nuisance, has been a "fair play" consideration on the part of municipal authorities. While convinced that the emission of black smoke from boiler chimneys could be abated, they have felt that to try and stop the belching forth of dense volumes of smoke from the stacks in ironworks, puddling and heating furnaces, brewers, coppers, etc., would be to interfere with industry. Hence the reluctance to interfere with one, if not the other. The evidence is, however, that the "Meldrum" furnace has been applied as successfully to metallurgical and brewing furnaces as to boilers, resulting in large economies in cost of working, in some cases as much as 50 per cent. in the cost of coal having been saved.

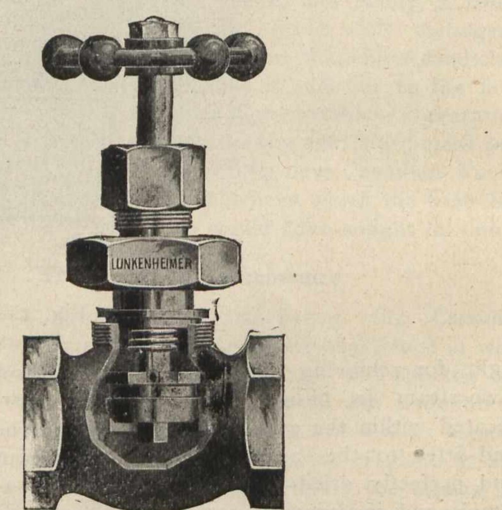
One word more. In our investigation we have only come across one firm using this furnace in Canada; and here is what they say about it:—

"I am pleased to say we like it very much. It has been working over four months and we believe it verifies your claims—it certainly effects a marked economy in fuel; especially in being able to burn a much lower grade—as a smoke consumer if properly used it is the best we know of, and it should satisfy the sanitary board of any city. The grate bars are as straight and smooth as when first put in—the clinkers never stick to bars and are very easily removed. We are so well satisfied with it that we have given an order for another."

In stating the case for this particular furnace, we have no interest further than public health, science, and the spread of sound economic ideas.

REGRINDING VALVES.

Of late years the improvements made in regrinding globe valves have been numerous. For half a century the Lunkenheimer Valve has proven itself to be the correct design, and the satisfaction given by its use has been universal. Its manufacturers, The Lunkenheimer Co., Cincinnati, Ohio, have, however, made some changes, which are not at all radical. The weight of the valve has been increased, not



because the former product was too light, but as a precaution against rough handling, while fitting, etc. The medium weight valves are guaranteed to stand a working pressure of 200 lbs. per square inch, and the extra heavy ones up to 350 lbs. per square inch. The shape of the valve has been altered somewhat, giving a better appearance, and increasing the area of the passage through the valve, the area being greater than that of the connecting pipe. To insure a tighter and stronger joint the thread has been made longer, thereby overcoming the danger of stripping threads, which so often happens, when fitting is done by unskilled workmen. All sizes of valves now have lock-nuts on the hand wheels, which facilitates the taking apart and assembling for repairs, etc.; the valve can be packed under pressure, when opened or closed. The material is of the highest grade of bronze, and the workmanship throughout is of the very best. Every valve is thoroughly tested, and ready for use when leaving the factory.

SYSTEM IN INDUSTRIAL ESTABLISHMENTS

BY A. J. LAVOIE.

(Registered in accordance with the Copyright Act.)

THE ORDER—CONTINUED.

Article VII.

On form No. 27 (page 336) you will perceive the following instruction, "please supply the stores with the following articles, rough and finished."

When the store-keeper fills in requisition form No. 27 in detail, it is advisable to enter all articles to be both "rough and finished," on one or more sheets—if required; while articles to be "rough" only, should be on a separate sheet, as also should articles to be "finished" only. Upon filling in requisition for rough articles only, the words "and finished" should be crossed out. On the other hand, if the articles are in stock, and have to be "finished" only, then the words "rough and" should be cancelled by marking out. By so doing you will enable the Production Office to prepare their requisitions to the departments interested, in an intelligible manner, and avoid unnecessary enquiries.

PATTERN No.	MATERIAL OF PATTERN.	No. OF PIECES IN PATT.	No. OF CORE BOXES.	IN BUILDING No.	ON FLAT No. / IN RACK No.	ON SHELF No.
NAME OF ARTICLE.	SIZE AND SYMBOL OF MACHINE.	TYPE OF MACHINE.	REMARKS:			
DRAWING No.	JOB No.	APPROVED BY SUPERINT.				

A. J. Lavoie's System No. 99 Pattern Index in Eng. Dept. No. 3.

Printed Red of 20 lbs. Amber color Bond Paper.

Now suppose 10 cylinders are required, as per drawing No. 10602, pattern No. 6314,—to be both rough and finished, and cast from alloy No. 106, each weighing 326 lbs. It will, in the first place, be necessary for the store-keeper to fill in general store requisition No. 11516, for job No. 19602. This will be passed on to the Superintendent's office for approval—then transferred to production office, where one original of form No. 29 and four carbon copies off same will be prepared, and the latter issued to the following departments:

One for the stores department, original copy.
One for the patterns department, No. 8.
One for the foundry department, No. 7.
One for the machine department, No. 5.

the last of the carbon copies being sent to the cost office to serve as a warrant or record.

If, however, rough castings only are required, it will not be necessary to send a copy of form No. 29 to department No. 5, since no machine-work is needed; the total number of lists to be issued is reduced to 4. But if the cylinder castings are in stock—in a rough condition, and it is desired to have them finished, then 3 production lists only are to be issued, as follows: The original copy for the stores, the duplicate for Dept. No. 5, and the triplicate for the cost office.

From this it will be seen, that each department receives orders only for such articles as are dealt with therein.

The question then arises, what happens in the respective departments, after the production lists have been received. The procedure is as follows:

The production list, form No. 29, together with instruction card No. 11 and 12, are delivered to the general foreman in charge of the department, if an estimate has been made, or if it is the first time the specified article or articles are to be produced. But if said articles have been made in the past, then instruction cards, No. 11 and No. 12, should already be in the files of the general foreman's office, indexed according to drawing number, if any, or under the specific name of the article, if there is no drawing number. At this

REMARKS:											15

Color of printing to be the same as the other side of form wherever it may be used.

stage, the usefulness of form No. 11 and No. 12 will be apparent, since (1) it will indicate which is to be the first, second or third operation, etc; (2) what tool or machine has been selected to perform the necessary operations; (3) the cutting depth to be taken; (4) the tool feed selected; (5) the cutting speed desired—based upon past record of the machine for strength, etc.; (6) the time allowed for each operation (a distinction being made between the time occupied in performing operations on the first article, and that taken on the rest of the series, hence the necessity of averaging); (7) it enables the management to apportion the work of both men and machines; (8) provides in advance for the work of each employee or tool, in accordance with time of delivery promised. (9) Effects the centralization of all executive shop-work in the general foreman's office—in accordance with the rational system of one tool room for each department, instead of one tool room for each sub-foreman; (10) it gives the only true basis for a bonus system—a plan which has many advantages; since if the employee makes better time than you have figured upon in making your estimate, it means clear profit to both employer and employee; and if, on the other hand, the workman fails to reach the specified time limit, changes in red ink over the estimated time establishes an accurate and reliable guide in the estimation of future work of like character, and (11) it enables the management to determine who are the best estimators,

Pattern No.	Material of Pattern.	Nos. of Pieces in Patt.	Nos. of Core Boxes.	In Building No.	On Flat No.	In Rack No.	On Shelf No.
Name of Article.	Size and Symbol of Machine.	Type of Machine.					Over
Drawing No.	Job No.	Approved by Superint.	Remarks:				

A. J. Lavoie's System No. 100   Pattern Index in Engineering Dept. No. 3.

Printed Red of 100 lbs. stock. Amber color (Parchment Board.)

and to regulate equitably rewards and advancements as occasion arises.

Having explained the progressive course of the production lists, from the receipt of the original requisition from

sistent with clearness, the manner in which the work is carried on, until the pattern is made, checked, approved, ready for the foundry department No. 7, etc., and finally returned to pattern vault for storage.

Remarks:									

15

Color of printing to be the same as the other side of form wherever it may be used.

Pattern Shop.

The order to make a new pattern, or change an old one, originates in the engineering department, No. 3—see form No. 15 and 99, also No. 15 and 100.

A. J. Lavoie's System No 108   Production Dept. No. 4

Prepared by ....   ● ORIGINAL ●   Date Completed ....

A. J. LAVOIE'S SYSTEM, Longueuil, P.Q., Canada

PATTERN COST REPORT

Number of Sheets required to complete Report........ Sheet No........

Drawing No.	List No.	Pattern No.	Mat'l Cost $	c.	Labor Cost $	c.	Total Cost $	c.	Time taken in Hours	Bonus. Time Saved	Bonus. Money Paid $	c.
		Totals										

Time taken in hours as per above figures			*Approved by Cost Clerk.*
Total Cost as per above List			*Approved by Chief of Dept. 4.*
% allowance for Dept's Nos. 2, 3, 4.			
Total Cost for Making			*Approved by Estimating Engineer.*
% allowed for Dept. No. 1.			
Total Cost for Manufacturing.			*Approved by Superintendent.*
			JOB NUMBER

Change from No. 108 to No. 109 for duplicate copy. Change word Original to Duplicate for form No. 109. Printed blue 20 lbs. Pink Bond Paper. Padded on top only.

engineering department, to delivery of copies of production list to the respective works departments; and final returns of these to, and filing in, the cost office in department No. 4, we are now in a position to deal with the pattern department No. 8. It is purposed to indicate, as briefly as is con-

In numbering the patterns, the engineering department, No. 3, is guided by the following rules:

(1) Each pattern must have a separate number.

(2) Every alteration to a pattern which will affect duplication, or change the appearance to a large extent, will

necessitate the recording of this change on the old card, and the making of a new card having a new number; this will not be necessary, however, if the change is merely in machine work, as the drawing number only will change.

(3) If an existing pattern is found to be defective or weak necessitating lagging or strengthening, it will not be necessary to give a new number, since the alteration is permanent, and only remedies discovered defects; the general shape and form being unchanged.

(4) But if a lug is added or an extension made to an existing pattern, a new pattern number must be selected for the lug only, and the pattern card for same clearly marked, thus:—"this pattern to be used in connection with pattern number 52, No. 1054 or 16856," etc. Whatever the case may be, full information should be given so that the lug pattern may be easily found and assembled with the major pattern.

(5) Never more than one pattern number should be marked on a pattern, no matter how many combinations there may be. The precise location is specified on the index card.

(6) To order a new pattern, the Engineer will fill in triplicate—by means of carbon paper—two copies off form No. 15 and 99, and one off form No. 15 and 100, retaining form No. 15 and 100 in the engineering office pattern index file until original form No. 15 and 99 has been returned from pattern department. On receipt of original form No. 15 and 99, the engineering office clerk will copy data on same, upon card form No. 15 and 100, and despatch original form No. 15 and 99 to the cost office; which means that the pattern is completed and indexed. The duplicate of form No. 15 and 99 is also sent to the cost office as a warrant, and to serve as a record and chaser of the original form No. 15 and 99;—because the duplicate form No. 15 and 99 has to be kept in a separate file in the cost office until the original form No. 15 and 99 is returned to the production office, and from thence to the engineering department No. 3; in which department they enter on their record card—form No. 15 and 100—the location of the pattern, date completed, etc. After form No. 15 and 100 is filled, the original form No. 15 and 99 is sent to the cost office, denoting that all the work relating to this particular pattern is completed, and that the cost of said pattern can at once be prepared in duplicate, on original form, No. 108, and duplicate form No. 109.

(To be continued.)

Yale & Towne Portable Electric Hoist. In use in the works of Wm. Cramp & Sons Ship and Engine Building Co., Philadelphia, Pa.

ELECTRIC HOISTS.

The distinctive features of this hoist are its *steel construction and portability.* It can be shifted from place to place like a chain block, may be used wherever current is available, and is almost as easily wired as an incandescent lamp. The operation of the device is easy, construction simple, and the parts are made of the best materials obtainable; all finished and assembled with the same care and workmanship that characterizes all Yale & Towne products.

These hoists may be used to increase the efficiency of hand cranes, and are so compact that they may be hung up and operated in small space. The single upper hook makes a flexible connection to overhead supports, so that lifting may be done at an angle without causing side strains on the hoist. Where head-room is limited, the upper hook may be removed and the hoist connected closely to the trolley, thereby taking up less head room than any other power hoist.

All parts are made to gauge, thus securing complete interchangeability. The motor is placed above the oil-submerged gearing, preventing the possibility of oil entering the motor. The oiling devices preclude heating or injury from the high temperatures usually existing near the ceiling.

The load is taken on wire hoisting rope of tough steel, wound on grooved drums. At the bottom hook the rope passes around an equalizing sheave, thereby balancing the strain. All parts under tension or subjected to transverse stress are of forged steel or wrought iron.

These hoists are operated from the floor near the load to be handled.

One of the finest of the big new factories recently erected in Toronto is that of the Dunlop Tire and Rubber Goods Co., which is now in full swing.

The new plant of the Ogilvie Flour Mills Company, which is nearing completion at Fort William, will be one of the greatest in the world. The mill building proper will have a daily capacity of five thousand barrels of flour.

A half million dollar company has been incorporated by patent letters issued in the office of the Secretary of State, to be known as the Ontario Car Ferry Company. It will carry on the transportation business throughout Canada. C. M. Hays, E. H. Fitzhugh and John W. Loud are well-known names which appear among the list of incorporators. Montreal will be the headquarters of the new company.

THE DE LAVAL STEAM TURBINE

Dr. De Laval
Born 1845.

The De Laval Steam Turbine—the invention of Dr. Gustaf De Laval, of Stockholm, Sweden, is the chief representative of the type known as the "impact" or "velocity" turbine. Invented in 1888, it has been in successful service in Europe and the United States for upwards of thirteen years, hence has had the thorough test of time; and, by careful correction of defects developed in trial, and wise economy in mechanical details, has attained to a high degree of perfection in construction, and efficiency as a prime mover—especially for small powers. Designed originally many years ago to drive centrifugal cream separators, it has been developed and applied effectively to a large variety of apparatus—direct and alternating current generators, centrifugal pumps, pressure blowers, spinning mills, etc.

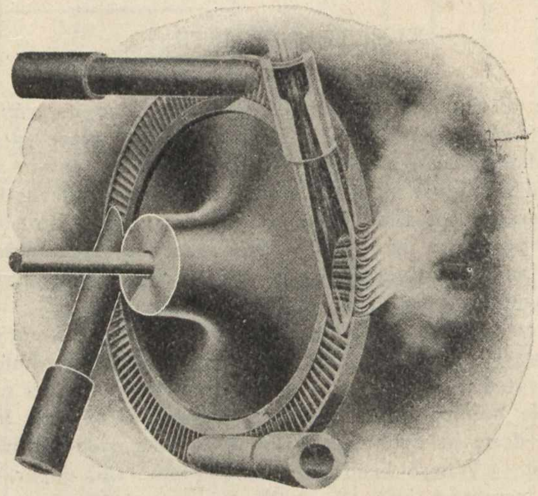


Fig. 1.
Wheel and Nozzles.

The essential difference between the De Laval "velocity" and Parsons "*pressure*" type of steam turbine is, that the former has only one ring of rotating vanes as shown in Figs. 1 and 5, whereas the latter may have as many as eighty rows; with 30,000 vanes in an engine of large magnitude.

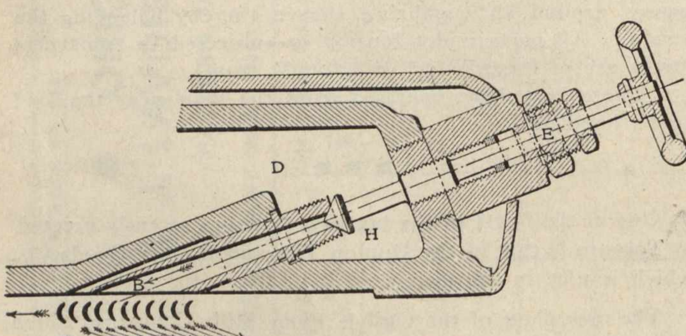


Fig. 2.
Sectional Nozzle and Valve.

Figs. 2 and 3 show in detail the single rotating disc and steam nozzles. The nozzles are conical, having their larger diameter at the exit, and are so designed that steam is expanded in the nozzle from boiler pressure down to that of the condenser, or, in the case of a non-condensing turbine, down to the atmospheric pressure, before impinging on the moving vanes. The work done by the steam during this expansion is taken up in giving kinetic energy to the steam; and in the case of a nozzle delivering steam at a pressure of 200 lbs. per square inch into a vacuum of 28 inches of mercury, The velocity of efflux is 4,130 feet per second.

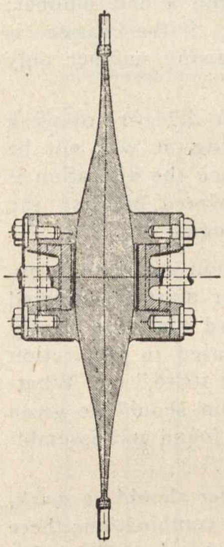


Fig. 3.
Section Turbine Wheel.

The angle between the nozzle and the plane of rotation of the wheel is 20°, and to obtain the maximum efficiency, the peripheral speed of the turbine disc should be 47% of the velocity of the steam jet. The energy absorbed by the turbine is then theoretically 88% of the kinetic energy of the steam. Owing to the limited strength of the materials of construction, it is at present unsafe to give the wheel a peripheral speed of more than 1,380 ft. per second. This is obtained in the 300 HP. turbine by giving the disc of 30 inches diameter, a velocity of 10,600 revolutions per minute. There are no guide vanes, since the steam is only passed once through the wheel, and as ample clearance is allowed between the fixed nozzles and the moving vanes, there is no chance of any rubbing taking place. Setting of the turbine disc at these high speeds is permitted by the simple device of mounting the disc on a shaft of small diameter—the diameter of the shaft for a 300 HP. turbine is only 1 5-16 inches, rotating in bearings adjustable, which are at a good distance apart. The flexible shaft has, therefore,

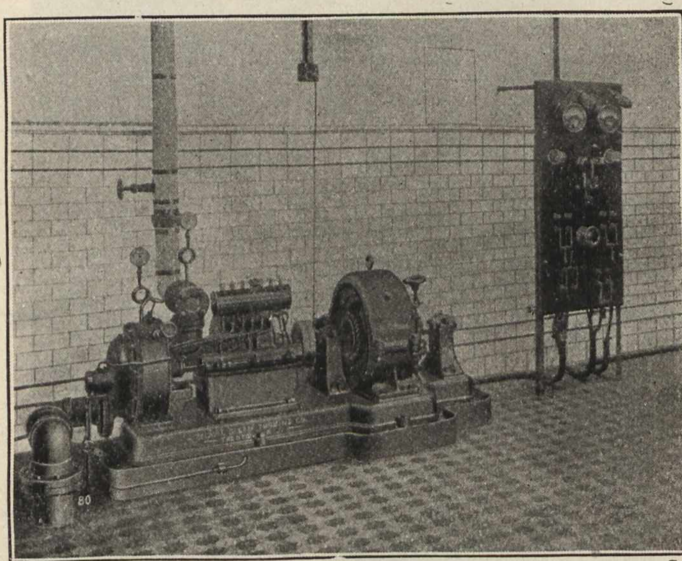


Fig. 4.
Thirty HP. Generating Set in Power Plant for Lighting the Sign on Roof of Building.

considerable play, and allows the rotating wheel to revolve on its true axis, as distinguished from its mechanical axis; and permits the centre of gravity of the rotor to take up its natural position when rotating. The wheel is made as a solid disc, to the circumference of which the buckets are dove-tailed, each bucket being separately fixed.

The disc is so proportioned as to be weakest near the circumference, so that, should rupture take place through an abnormal increase in the centrifugal stress, the buckets will be thrown off without doing serious damage, and will thus relieve the main body of the wheel. The rotor shaft is connected to a parallel second motion shaft by means of spiral gear wheels, giving a reduction in velocity of 10 to 1. Governing is performed by means of a centrifugal governor, which acts by completely cutting off steam from one or more of the steam nozzles, the remaining nozzles being unaffected. The velocity of efflux of steam from the working nozzles is thus kept constant for all loads. By fitting more nozzles than are necessary for the normal load, overload up to 50% can be driven, the efficiency of the turbine increasing with the overload."

The De Laval Steam Turbine finds its principal application in the driving of direct and alternating current generators. The speeds used on the geared down shafts are such as are extremely well adapted for direct connecting the machine to direct and alternating current generators. The speeds range from 900 r.p.m. for 300 HP. turbines, down to 2,400 and 3,000 r.p.m. for the 10 and 7 HP. size. In recent practice it has been found advisable to construct high-

With regard to steam economy, the following is a record of recent tests:

Steam Consumption per Brake Horsepower per Hour. 150 pounds pressure; 27" vacuum.

	300 HP.	110 HP.	55 HP.
Full load	16.6	18.4	22.5
3-4 "	17.3	19.0	23.0
1-2 "	18.5	19.9	23.5
1-4 "	22.5	23.0	25.5

The above figures are for commercially dry steam. It will be perceived that the economy at half and quarter loads

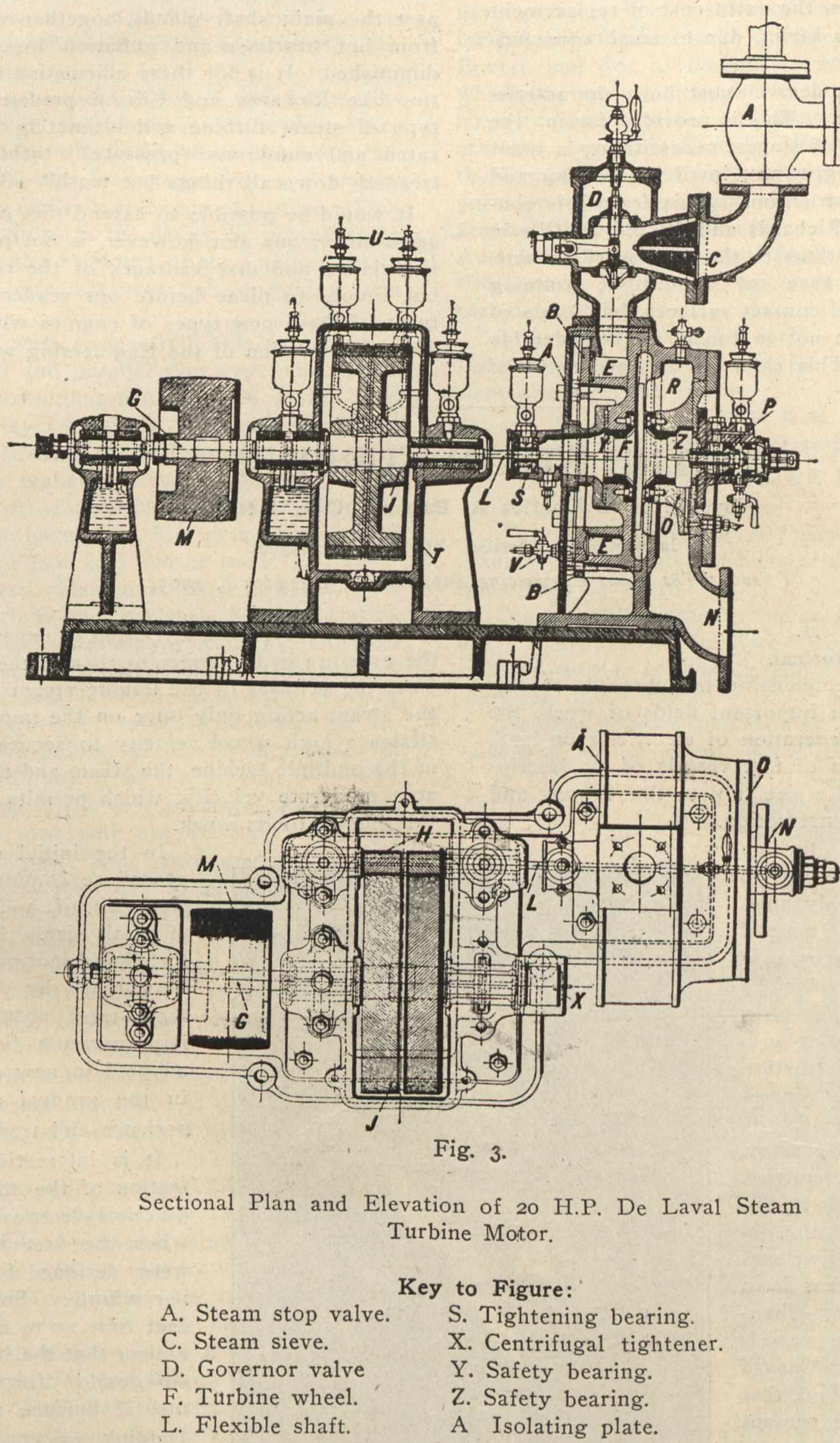


Fig. 3.

Sectional Plan and Elevation of 20 H.P. De Laval Steam Turbine Motor.

Key to Figure:

A. Steam stop valve.	S. Tightening bearing.
C. Steam sieve.	X. Centrifugal tightener.
D. Governor valve	Y. Safety bearing.
F. Turbine wheel.	Z. Safety bearing.
L. Flexible shaft.	A Isolating plate.

power De Laval turbines—75 HP. and larger, with a double set of gears. This requires, for direct connection to it, a double armature or double rotor generator; and such an arrangement has incidentally some advantage and no disadvantage, except in first cost. In direct current machines it renders available without additional expense two voltages from one generator and generally contributes to the smoothness of running and balance of the machine. For alternators operating in parallel the even turning movement makes the operation of two or more generators a very simple matter, and they are very easily thrown into multiple.

is not much below that for full load. The growing favor, however, into which the use of superheated steam is coming, makes of interest the performance of the De Laval turbine on superheated steam. It is found that with steam of superheat 100°F. the figures above are reduced approximately 8% and 13%—with steam superheated at 200°F. above the temperature due to its pressure; and the manufacturers claim that the De Laval steam turbine is ideally suited for these conditions.

As pointed out by Mr. Parsons on page 14, one of the chief objections to the De Laval Turbine is the terrific speed of the turbine wheel. The velocity of the steam jet is as high as 4,130 feet per second. This high peripheral velocity necessitates a high speed of rotation; speeds of from 10,600 r.p.m., for 300 HP., to 30,000 for 7 HP., being found necessary. Hence, to reduce this high speed of rotation, gears have to be resorted to, and even then the speed is from 900 to 3,000 revolutions per minute. In "velocity" turbines driving continuous current dynamos it has been found that the high peripheral speed of the commutator gives rise to a considerable amount of difficulty with the brushes, though it has been found possible to design carbon brushes to run satisfactorily on a 500 K. W. machine running at 1,800 revolutions per minute. Above this power however, brushes of wire gauze are necessary, and even then, in many cases, the extra cost of replacement of these brushes exceeds the saving due to small consumption of lubricating oil.

Expansion to the fullest degree must be a characteristic of any economical engine. This is provided for in the Parsons turbine by a series of stages, necessitating a great number of fixed and moving vanes, involving a long and heavy rotor, and costly construction. This feature is considered by critics like John Richards and Arnold H. Gibson to be one of the chief objections to the "pressure" turbine, since it exacts the maintenance of steam-tight running joints; in this case not actual contact surfaces, but joints of such precision that although not in touch, no considerable leak must pass through. This calls for an accuracy of work that cannot be attained by ordinary tools, and ordinary skill. On the other hand, the De Laval engine avoids this, by a single application of the steam: first expending it to the pressure of the atmosphere, and converting the expansive force into steam. It is claimed, moreover, that owing to the reluctance of the steam jet to diffuse on leaving the nozzle at high velocity, it is possible to have an amount of clearance between stationary and moving parts, altogether out of the question in the case of the Parsons Turbine. While due to the fact that the steam pressure, and hence the temperature in the turbine casing is low, the constructional and maintenance difficulties arising from unequal expansion of the fixed and moving parts, leakage past the main shaft glands, together with troubles arising from hot bearings and radiation losses, are considerably diminished. It is for these affirmative reasons that authorities like Richards and Gibson predict that the "velocity" type of steam turbine will ultimately displace the complicated and cumbrous "pressure" turbine. "Time which treadeth down all things but truth" will show.

It would be possible to extend this *pro* and *con* discussion *ad infinitum*; our aim, however, is not primarily to set forth the claims and disadvantages of the rival turbine systems, but simply to place before our readers the essential features of these new types of engines which are now engrossing the attention of the Engineering world.

THE STEAM TURBINE

By the Hon. Charles A. Parsons, C.B., F.R.S.,

Inventor of the "Parsons" Steam Turbine Engine.

(From "The Times Engineering Supplement," December 1, 1905.)

I.

Historical.

The steam turbine is commencing to supersede the reciprocating engine in certain important fields of work, the most notable being in the generation of electricity on land, and at sea in the propulsion of fast vessels of all descriptions, from those of moderate size up to the largest and fastest vessels now under construction.

The introduction of the turbine commenced in 1884, when a 10 horse-power turbine and dynamo, constructed according to general principles, which have been uniformly adhered to in all turbines of the compound or multi-stage type, comprising the largest sizes at present in use and under construction for driving dynamos for the generation of electricity in England, the United States, France, Germany, Austria, Russia, and other countries. The same principles have been involved in, and have governed the design of, the turbine propelling machinery in all vessels starting from the "Turbinia," including cross-Channel turbine craft, mercantile vessels and yachts, the Allan and Cunard liners, and all turbine warships that are under construction at the present time, with only one or two exceptions.

Hon. Charles A. Parsons.

The system adopted in 1884 was that of causing the steam to pass through a large number of turbines in series, suitably proportioned so as to utilize the expansion of the steam, which flowed at a comparatively moderate velocity, because of its circuitous course through the many turbines of the series, just as is the case with water flowing through a long course of rapids from a lake of high level to one of lower level, the lake of high level corresponding to the boiler and the one of lower level to the condenser. This principle differs from that adopted some years later by Dr. de Laval, of Sweden, where the steam is allowed to issue from a jet, and to expand in one stage from the pressure in the boiler to that in the condenser. In this case, the velocity of the issuing steam being enormous, and the steam acting only once on the impulse wheel, it necessitates a high wheel velocity to secure efficiency, whereas, in the multiple turbine, the steam and the wheels move only at a moderate velocity, which permits of directly coupling the engine to its work.

In the initial stages the course of procedure commenced with the construction of a few turbine engines of small size. These were carefully tested and sent out to work, and closely watched by competent men. Defects were promptly remedied, and improvements discovered which were adopted in new designs, and resulted in the gradual accumulation of experience and trade knowledge.

It is interesting to note an illustration of the state of knowledge of practical electrical engineering in 1884, when the first turbine and dynamo were designed for 18,000 revolutions per minute. So little was known at that time as to the behavior of magnetism that the late Professor George Fitzgerald (professor of Experimental Science at Trinity College, Dublin) was consulted as to whether he thought that any anomalous results were likely to arise at such an excessive speed, and whether the magnetism would lag behind or would behave itself properly. He replied at considerable length to say that he thought the magnetism would behave itself, and the increased output anticipated would probably be obtained; and so it proved when the machine was tried.

In the first year three engines were set to work; in the next year ten, and so on until at the end of the fifth year 350 had been put into successful operation, all of the non-condensing type, aggregating 4,000 horse-power.

In 1888 working plans were prepared for a turbine of the condensing type, which presented hopes of realizing unprecedented economy in the use of steam for motive power and of a great step in the development of the turbine.

It was not until 1891, however, that facilities were available for its construction, and the anticipations were at length fulfilled when, in the following year, a 100-unit condensing turbo generator was found to consume only 27 lbs. of steam per kilowatt hour, thus equalling the performance of the best triple-expansion engines of that date in the driving of dynamos, and foreshadowing the ultimate general adoption of the turbine—at least in large sizes—for the driving of dynamos and alternators and other fast running machinery, and also of its probable ultimate adoption for the propulsion of fast vessels.

The turbine which achieved this result differed materially from that designed in 1888, because of the temporary loss of patent rights under which the work had been carried on up to this period; this loss compelled an alteration of design to the radial or multiple disc type of turbine. This resulted in such modifications in the design as proved to be seriously detrimental to the economy of the engine; yet in spite of these adverse circumstances, the progress was good.

In 1893 the patents were re-acquired; this permitted of reversion to the original and parallel flow type, and subsequent experience has shown that had the 1888 design been constructed in its entirety in 1892, an economy would at that date have been obtained about twenty-five per cent. superior to that actually realized. There is now no question that the turbine in its present perfected and economical form would in that case have come into general use about five years earlier both for land and marine work.

The results that were obtained in 1893, however, were sufficient to place the turbine on a par with the reciprocating engine of that day, and to lead gradually to its extended use for the generation of electricity, and also to justify the formation of a syndicate a year later for practically applying the turbine to the propulsion of vessels. In 1896 the anticipations of eight years before, as to the attainment of very high degrees of economy from the parallel flow type, commenced to be realized in the case of large turbine units on land, culminating in 1900 with the excellent result of 18.8 lb. of steam per kilowatt hour when generating 1,400 kilowatts. Soon afterwards with 15.4 lb. per kilowatt hour when generating 4,000 kilowatts, and finally 14.7 lb. per kilowatt hour with a higher degree of superheat in the steam.

A simple explanation might be asked for as to why the turbine should be more economical than the reciprocating engine. The answer is that the turbine is able to expand the steam fully and economically from the boiler pressure right down to the condenser pressure, while the reciprocating engine is unable to expand it the whole way—as a matter of fact, it can only expand it usefully for about two-thirds of the way.

This is the chief difference; the other differences nearly compensate each other—for instance, the turbine has more waste from leakage, while the piston engine has a large waste from condensation and re-evaporation, which does not occur in the turbine. Then, again, the turbine has fluid friction from steam and water, and very little mechanical friction, while the reciprocating engine has much more mechanical friction and very little fluid friction.

In the case of the "Turbinia" in 1897, the economy obtained in propulsive horse-power in relation to steam consumption was as good, if not better, than had been previously realized with reciprocating engines in similar vessels. The turbine engines worked with greater economy than ordinary engines, but the screw propellers with less efficiency than ordinary screws of the usual pattern employed with reciprocating engines. Since the original trials of the "Turbinia," many experiments have been made with her and with other vessels, which have yielded much information, and have led to a substantial improvement in the proportions of the screws for turbine vessels, and have afforded much assistance in obtaining the excellent results that have been realized in the many turbine vessels which have since been built.

Up to 1895, the compound turbine was manufactured only in England, with the exception of the tentative manufacture of a few small plants in Paris by two licensees. At this time, when about 20,000 HP. had been constructed in England, the Westinghouse Machine Company, of Pittsburgh, acquired the sole rights of manufacture for the United States; but very few plants were constructed by them until 1901, while since that date the manufacture has rapidly increased.

Turning to the Continental development in 1898, Mr. W. H. Lindley, of Frankfurt, advised the purchase of two turbo-alternators for generating electricity at Elberfeld, in Germany. These turbine engines up to that date were the largest constructed in England, and when tested in 1900, gave such excellent results as led to the commencement of turbine construction on an extended scale by Messrs. Brown, Boveri, and Co., at Baden, in Switzerland, a manufacture which has rapidly increased to large proportions, and many large turbo-alternators and dynamos constructed by them are now at work in Germany, France and Russia. In Italy the firm of Tosi are manufacturing turbines for electrical purposes on a large scale, and Messrs. Ansaldo Armstrong have acquired the right to manufacture in Italy for the marine. In Austria some of the largest-sized units are under construction, and in Russia two important firms are commencing to manufacture.

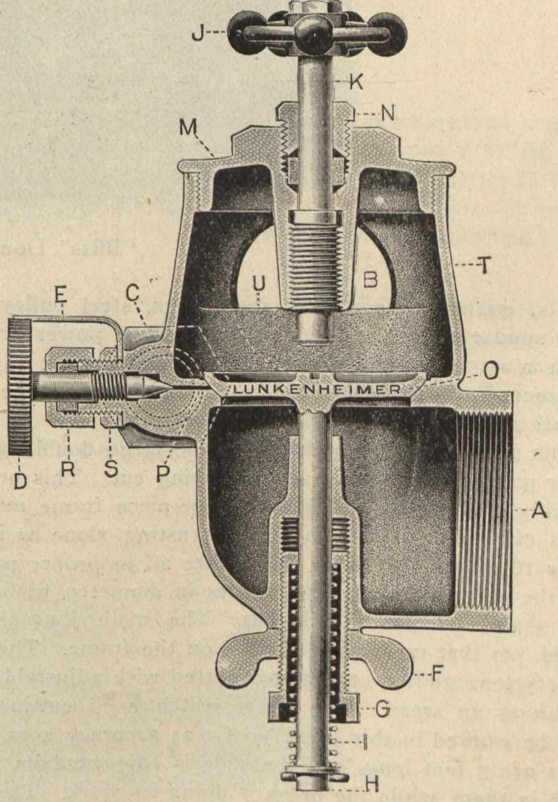
The adoption of the turbine in recent years for the generation of electricity and for marine propulsion will be treated in a second article.

AN IMPROVED GENERATOR VALVE. FOR GASOLINE ENGINES.

The generator valve shown in section below, embodies a number of desirable and important features, which will be appreciated by users.

A noticeable feature is the easy regulation of the spring, which holds the disc in place. This regulation can be done while the engine is running, and does not interfere with the operation of the valve.

Gasoline engines give the best results with the generator valve-disc spring set at a particular tension, and as this



tension can only be ascertained by trial when the engine is running, the adjusting arrangement of the valve illustrated, will be found a great improvement. The lift of the disc is regulated by means of the stem K.

The valves are made of high-grade bronze composition, and the parts subjected to the greatest strain are made extra heavy. Iron or steel is entirely eliminated, owing to the oxydizing effect of gasoline.

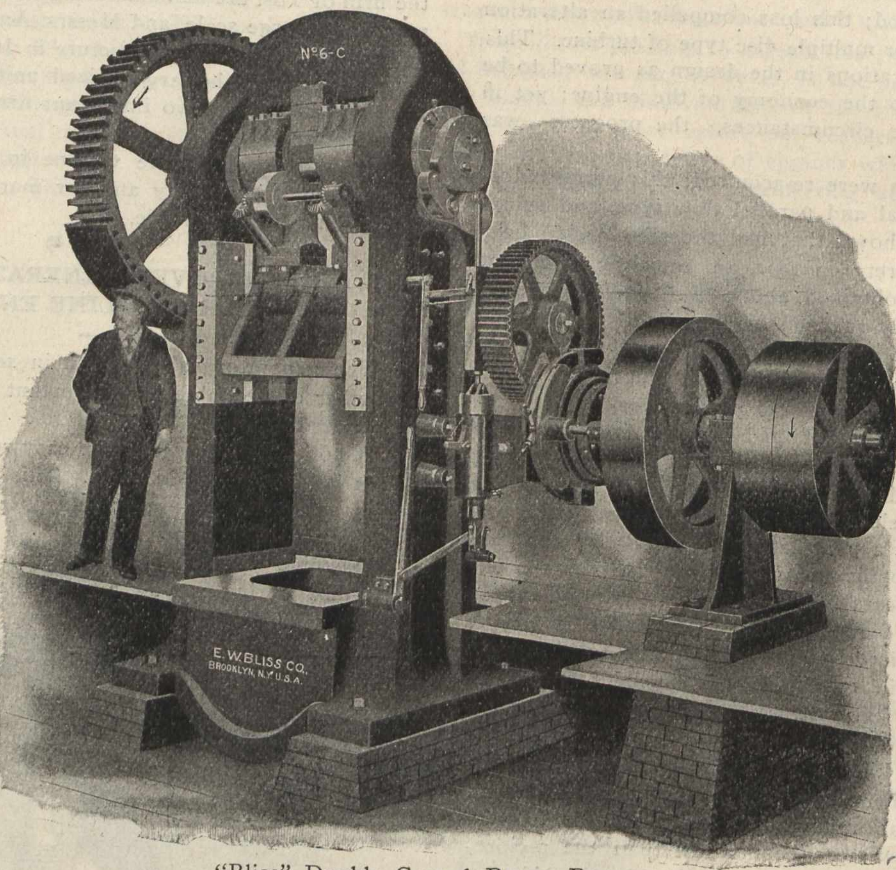
The Lunkenheimer Company, of Cincinnati, are the manufacturers.

A "BLISS" PRESS OF GREAT POWER

The art of rolling sheet metal has been so perfected that sheet steel, brass, copper, aluminum, silver and gold can be rolled into any required gauge, and the alloying of these metals is so thoroughly understood by experts that sheets for any purpose can now be prepared. The perfection of this industry has naturally led to another art—that of the manufacture of machinery and tools for making these sheets into such articles as buttons from the smallest to the largest, jewelry, pins, needles, clocks, lamps, all kinds of kitchen utensils, hardware of all shapes and sizes, such as skates, hinges, cutlery, mower sections, bicycle parts and fittings, rakes, wagon hardware, and many other different kinds of articles for all purposes; details of which are very numerous. Many of these articles are made on the smaller and entirely automatic presses, while the larger articles, as steel barrels, washtubs, foot tubs, steel sinks, steel pulleys and many similar articles, call for specially large power presses, which must be quick in their action and perfect in their movement carrying a cutting die as accurately as the most delicate machine made for watch work.

This has been accomplished in the large double geared power press shown in the accompanying cut. This press is probably the largest and heaviest one-piece frame machine of its class ever made—the frame casting alone weighing nearly 16 tons. The other details are all in proper proportion, the eccentric being 15½ inches in diameter, giving the main shaft a stroke of 6 inches. The main journals are bushed, so that no wear will come on the frame. The slide has very long guides, and is finely fitted with adjustable gibs for taking up wear. The finest watch hand cutting dies could be worked in this press, so far as accuracy goes. The guides are 3 feet long, and the slide is supported its whole length in them, while the press is doing its work. The slide has an adjustment of 2 inches in the connection. The distance between the columns is only 48 inches, as in this machine great strength is required, rather than a large bed area. The bed surface is nearly square. The distance from the bed to face of the slide when up is 42 inches. This gives room for the various special and intricate dies which are to be used.

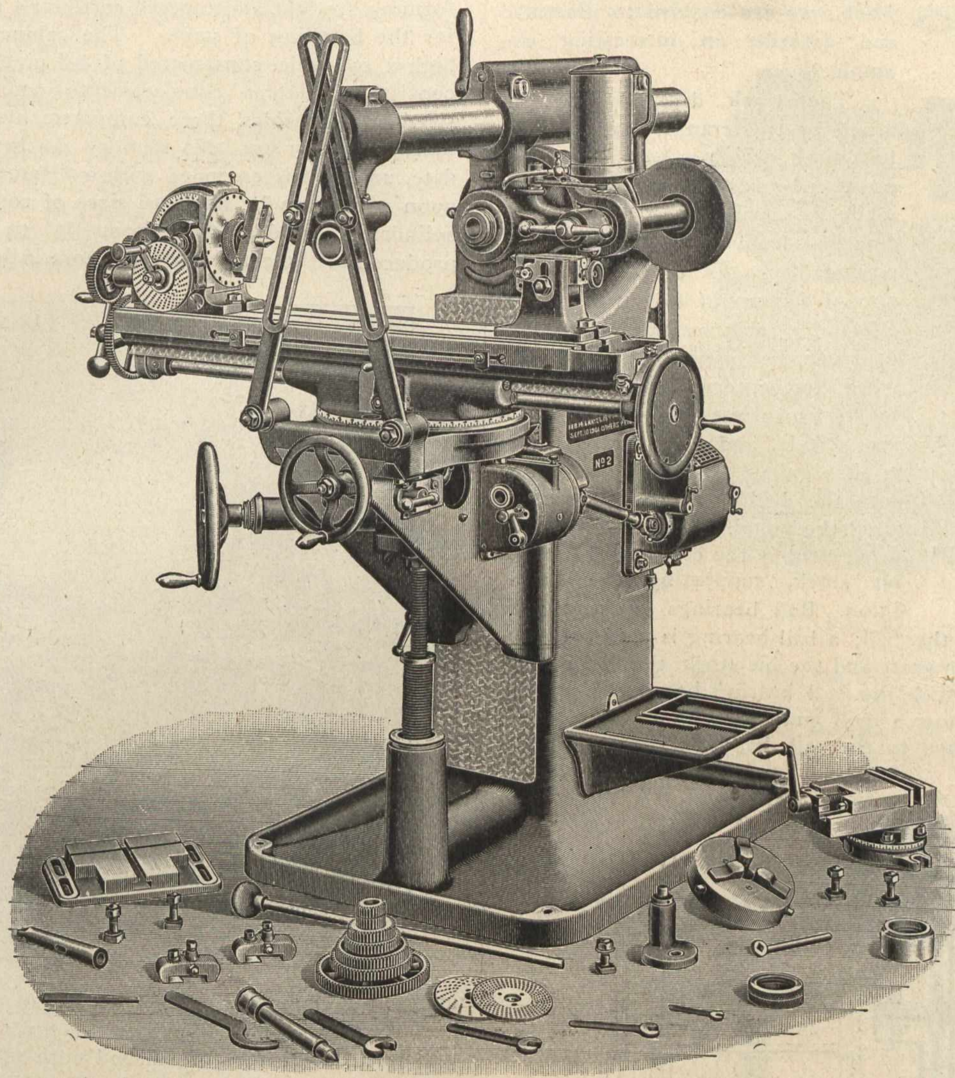
The machine can be handled as easily as a smaller one, as the stopping and starting can be done by hand, or by an automatic device, either of which can be almost instantly used. While setting the tools the machine can be operated with the hand arrangement, giving the operator full control of the slide movement. After he has set up the dies properly and then tried them with his hand trip and finds everything all right the automatic lever can be thrown in and the press operated in the usual manner, making one stroke at each depression and stopping at the top centre. Every convenience has been embodied in this machine for the rapid production of the work for which it has been built. The back shaft is fitted with an outboard bearing of large diameter and does not extend across the back of the press, as the back must be as accessible as the front below the slide face. All gears and pinions are cut from the solid, even the large main gear. All parts are well balanced and carefully fitted. The total weight of the machine is about 80,000 lbs. It has been designed and built by the E. W. Bliss Company, 21 Adams Street Brooklyn, U.S.A.



"Bliss" Double Geared Power Press.

UNIVERSAL MILLING MACHINES.

The need of a milling machine in machine shops, no matter how small, is becoming more marked from day to day. We illustrate herewith the Brown & Sharpe No. 2 Universal Milling Machine, with hand or automatic vertical feed. This machine embodies many features that make it even more accurate, trustworthy, and efficient than earlier machines of equal capacity. In designing this machine careful attention has been given to the arrangement of the various parts to insure ease of manipulation, compactness and simplicity. The parts are easy of access, a feature much appreciated in all machine tools, as it allows them to be properly cared for without unnecessary expenditure of time. The wearing surfaces and spindle bearings are amply proportioned to insure rigidity and to withstand the most severe service to which machines of this size and capacity should be subjected. The flat bearings are scraped to surface plates, kept true with master plates, not for a finished surface, but as a mechanical necessity to insure correct alignments. The cylindrical bearings are ground and fitted to standards; the feed and elevating screws are accurately cut and the alignments are correct. The machines are exceptionally rigid. Where great strength is required the metal is suitably disposed; for example, the upwrights that support the spindle bearing and the overhanging arm are solid and rigidly tied together by a brace forming part of the main casting. A feature to which we would call special attention is the feeding mechanism, driven direct from the main spindle by chain and sprocket wheels to the gear case, thus eliminating all intermediate gearing and insuring a positive uniform and powerful drive. Other important features that have been applied to this machine is the solid steel overhanging arm clamped by one lever at the front of the machine, a feed tripping mechanism of the double plunger type, a greatly increased range in swing of table, a telescopic knee screw that does not pass below the base of machine, and a method of indexing that permits all divisions from 1 to 380 to be made with the change gears and three index plates furnished.

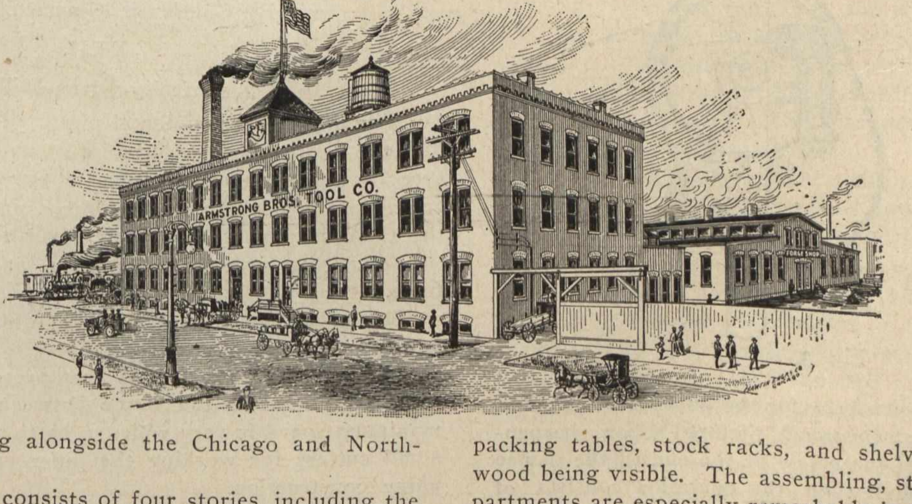


Milling Machine With Hand Vertical Feed.

Capacity: Longitudinal feed, 25 inches; transverse feed, 8 inches; vertical feed, 18 inches; both automatic.

A NEW PLANT.

Increase of business has made it necessary for Armstrong Bros.' Tool Company, Chicago, Ill., to erect a new plant, which is shown in the accompanying exterior view. The works are well situated, the ground being 200 x 216 feet; the 200 foot side being alongside the Chicago and Northwestern Railway.



The main building consists of four stories, including the basement; and is of standard mill construction, the stairways and elevators being enclosed in brick shafts, fitted with fireproof automatic closing doors. This building is 175 x 60 feet, with a one story annex 175 x 130 feet; the buildings are so located and arranged that perfect light and ventilation is secured. Machinery of the latest type has been installed; steel pulleys, with pressed steel hangers, and roller bearings are used throughout the entire plant. Wherever possible iron and sheet steel is used in partitions, benches, stands, drawers, packing tables, stock racks, and shelving; very little light wood being visible. The assembling, stock, and shipping departments are especially remarkable in this respect, and comprise one of the most complete and well designed steel fixture installations in the United States.

RAILWAY TRACK APPLIANCES.

The design of railway track tools has been greatly improved in recent years. Through the courtesy of Cooke's Railway Appliance Co., Kalamazoo, Mich., we are enabled to illustrate and describe an interesting example.

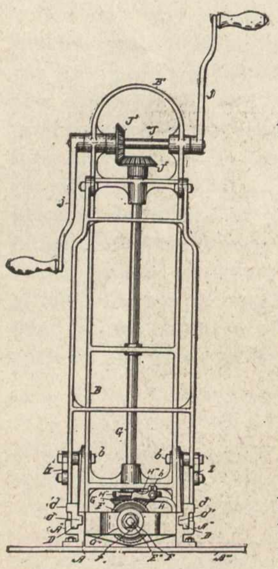


Fig. 1.

The track drill, Fig. 1, is turned by two cranks, bevel geared to a shaft, which is held in vertical position by jointed back brace rods while in service. The drill can be detached from the rail quickly by pulling back the brace rods. A special feature of this drill is the adjustable feed; by this means the drill can be made to turn faster when first entering the rail. The bit turns easiest when first starting a hole, and considerable time is thus gained by turning it faster until the drill point has fully entered the metal. An important improvement is the collar used on the bit stock, supporting the bevel pinion. Ball bearings are arranged to take the thrust of the drill; a ball bearing is used between the screw part of the shaft and the bit stock, the latter telescoping the former with the ball bearing between.

Figs. 2 and 3 show a drill and tool grinder, which can very easily be attached to the rail drill; no bolts or other

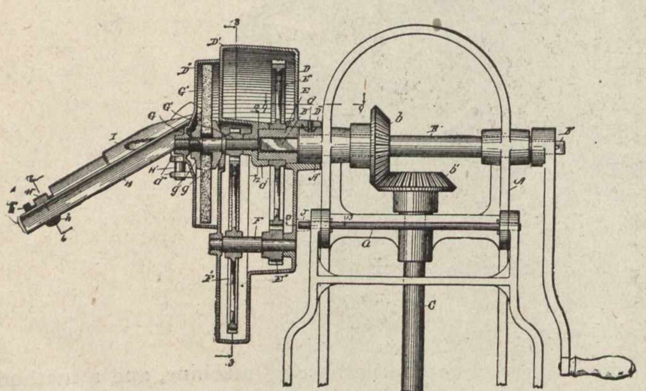


Fig. 2.

complicated fixtures being used in making the attachment. It is only necessary to remove the crank handle, and the grinder can be readily slipped on in its place; a quarter turn automatically locks the grinder securely to the rail drill, which serves as motive power in operating. As shown in Fig. 3, the disc which covers the emery wheel has an opening for grinding drill bits. The upper part of the disc is

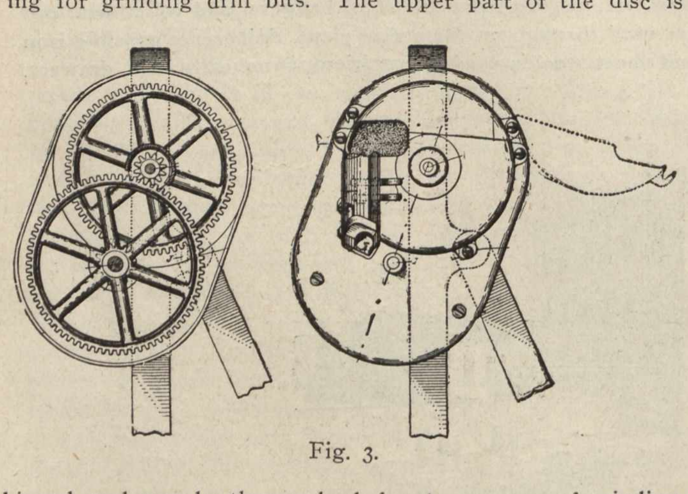
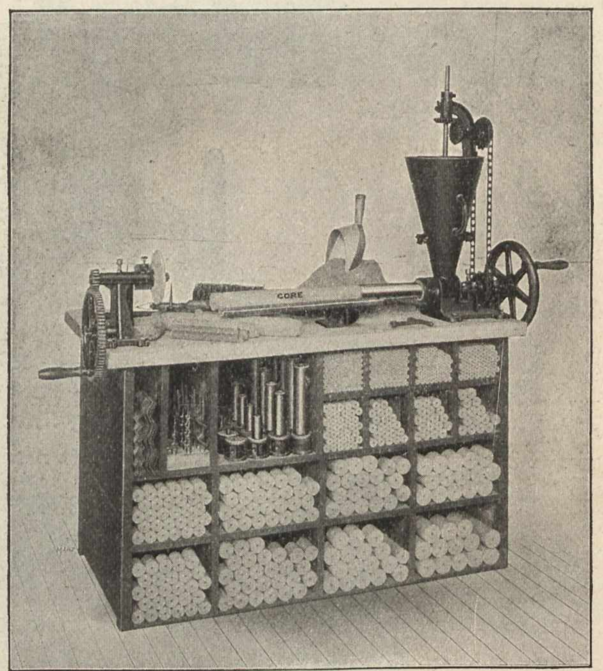


Fig. 3.

hinged, and may be thrown back for the purpose of grinding other tools. The only adjustment required when sharpening drills is by means of the screw at the end of the device for holding the drill, and then the operation consists of rocking the drill holder; a perfect cutting edge, with the necessary clearance, is the result

HAMMER CORE MACHINE AND CABINET.

The illustration below shows a valuable adjunct to the foundry; a cabinet specially designed for the storage of smaller centre cores, having table fitted with machines for forming straight and tapered cores, and commodious enough for the handling of same. The cabinet is 48" long x 30" high x 24" wide, constructed of ⅞" pine, with 1½" top. It consists of sixteen compartments—one for each standard sized core—besides three compartments for parts of the machine not in use. No foundry can be described as up-to-date, unless it is equipped with a "Hammer" Core Machine; upon which can be made 16 sizes of round cores—perfectly cylindrical,, graded ⅛ths, from ⅜" to 2¼" diameter, and produced at the rate of one 18" core in less than half a min-



ute. It is claimed that, upon a basis of five cents for wages, and a production of about 200 feet per hour, the machine will turn out 40 feet of finished core for one cent; a statement which would seem to be incredible were it not substantiated by nearly 1,000 users of these unique machines.

Up to recent date, only round cores were made on these machines, but recently the manufacturers have added equipment for making square, hexagon, octagon, triangular, quarter round, oval, and many other shaped cores.

In a subsequent issue we purpose dealing with this subject of machine made cores in considerable detail, having special reference to a new line of sand cores now being placed on the market by the manufacturers of the Hammer Core Machine, and which we believe will be profitable reading for the foundrymen of Canada.

MACHINE SHOP NOTES FROM THE STATES.

By Charles S. Gingrich, M.E.

XXII.

Electrically-driven Millers.

The days of experimental motor drive arrangements for machine tools are now practically over, and the manufacture of direct-connected tools is becoming rapidly standardized. The use of these tools has proven the truth of all the theories advanced in their favor for increased production owing to greater convenience and flexibility of the tools.

The problem varies according to the conditions under which each class of tool must operate, and what is perhaps the most difficult problem is that presented by the milling machine, on which the range between the minimum and maximum speed is very wide, so as to adapt it for large and small cutters for working the different metals used in machine construction.

An ideal arrangement for driving milling machines is shown in accompanying illustrations of a No. 4 Plain "Cincinnati" Miller with direct connected motor. The motor is mounted on the base of the machine, adding to its stability because of the extended base, brings the weight near the floor, and the motor is entirely out of the way, yet does not increase the floor space of the machine, because the space it occupies must be kept open in any event to accommodate the table travel.

The drive is by silent chains through a friction clutch direct to the spindle, and there are no additional speed change gears used. The motor gives a speed variation of 2½ to 1, and is controlled by the field rheostat mounted at the side of the column which gives 50 speeds within this variation, every one of which may be obtained in an instant, and these are multiplied by the double back gears to a total of 150 different speeds, giving the correct speed for any cutter.

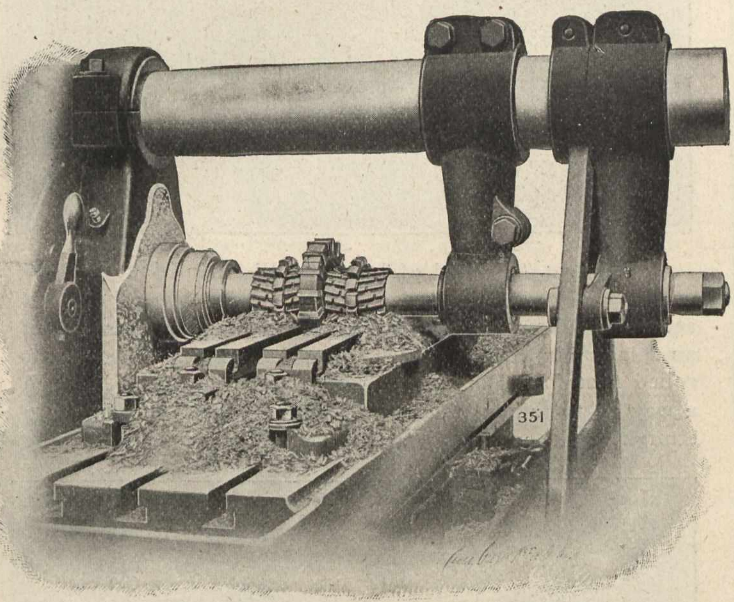


Fig. 1.

The object of the friction clutch is to give complete control of the spindle without stopping the motor, thus saving considerable of the operator's time which would otherwise be lost in starting or stopping. The clutch controlling the spindle is at the front of the machine within easy reach of the operator. In this way the motor is allowed to run continuously, and is always ready to pick up the load.

Figs. 2 and 3 show this machine at work. The following data are evidence of its capacity. It is finishing two great iron castings at one time. They are 3" wide, 1 1-2" thick, 5 1-4" long, and are finished across the top and one edge and have a slot 5-8x5-8" cut from the solid. The depth of cut overall is approximately 3-16", and the cutters are 8 1-4", 4 1-4" and 3" diameter. Novo steel, running at 38 r.p.m.—

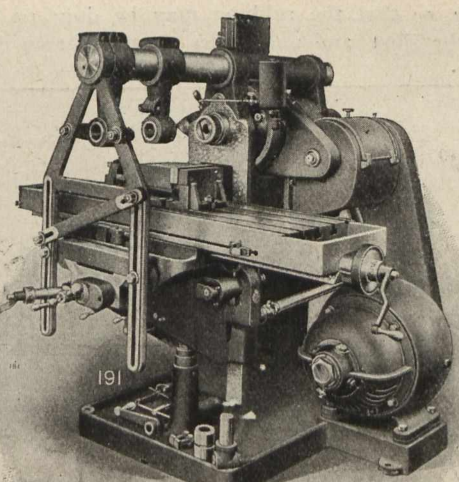


Fig. 2.

feed .100", giving a table travel of 3.8" per minute. It finishes these two pieces in eighteen minutes, including the chucking. The actual milling time is nine minutes. A 36"x36" planer using two heads, running at 55 ft., is not able to do this work in less than 36 minutes—just four times the milling time.

Because of the entire absence of belts and overhead works, and also because of the greater convenience due to

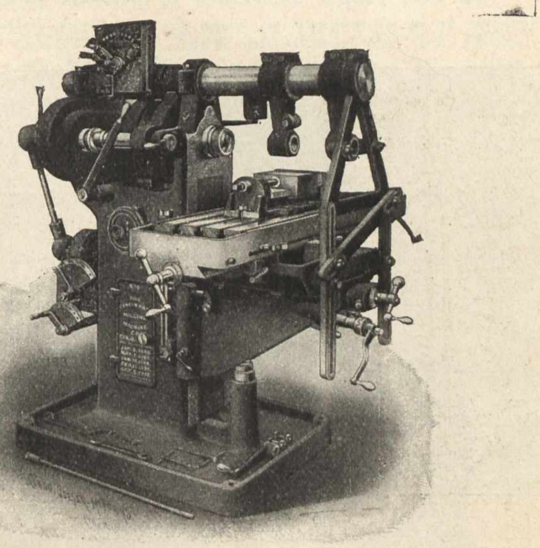


Fig. 3.

the ease with which the machine is controlled, and the facility with which any desired speed may be obtained, these machines are capable of turning out from 20 to 25% more work than these same machines belt-driven.

PROGRESS NOWADAYS.

When we get Niagara harnessed
And her useless cliffs and crags
Have been dried to feed the yearnings
Of our yawning money bags,
What a joy will thrill our bosoms,
All romantic nonsense drowned,
As we hear her torrents thunder
Through the wheel-pit underground!
Then we'll blast away Goat Island,
Turn it into building blocks,
Put a turbine in the whirlpool,
Build shot towers down the rocks,

How we'll pity our forebears
Prating of aesthetic taste,
While allowing thoughtless fellows
All those kilowatts to waste!
Forward, Spirit of Progression,
Nature's still a giddy shirk!
Tear away her fancy toggins,
Get her into trim for work;
Turn the Adirondack forest
Into neat and useful planks;
Straighten out the crooked Hudson,
Line with piers her grassy banks,

Crush the Dunderberg for pavements,
Make the Palisades cement.
Fill the Catskills up with signboards—
Lots of good rock space to rent,
Rip the redwoods into shingles;
Sow the Yellowstone to wheat;
Turn the geysers into laundries
And the bear and deer to meat,
What are mere aesthetic fancies,
Hill or vale, or wood or vine,
To the graceful curves and meaning
Of the pleasing dollar sign?

—New York Times.

FIRST AID: PERSONS SHOCKED BY ELECTRICITY

[Through the courtesy of the United Gas Improvement Co. of Philadelphia, we are enabled to reproduce the text and illustrations from their unique pamphlet on the treatment of persons injured by electric shock: which they have issued for the benefit of the many systems in which the Company is interested.]

To give proper assistance to persons shocked by electricity, it is necessary to have on hand the following mater-

Fig. 1.—Emergency Kit.

ials, contained in the company's emergency kit for electric shock cases, as shown in Fig. 1:

(a) A bottle of aromatic spirits of ammonia;

(b) A bottle of ordinary ammonia, with sponge attachment;

Fig. 2.—First Position of Person Under Treatment.

(c) A package of bicarbonate of soda (ordinary baking soda);

(d) A tin cup;

(e) A pair of tongue pliers;

(f) A towel;

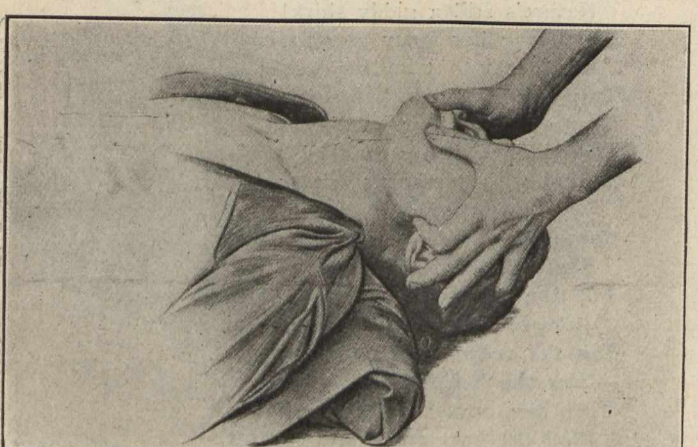


Fig. 3.—Method of Opening Jaw When Rigid.

(g) A package of antiseptic cotton;

(h) A roll of antiseptic bandaging;

(i) A roll of adhesive tape.

In case of electric shock, instantaneous death or only temporary unconsciousness may result. The treatment in both cases is as follows, and it should be carried out in every instance, even though the person is apparently dead, for he might be only temporarily unconscious.

Treatment.—Send for a doctor at once, in the meantime

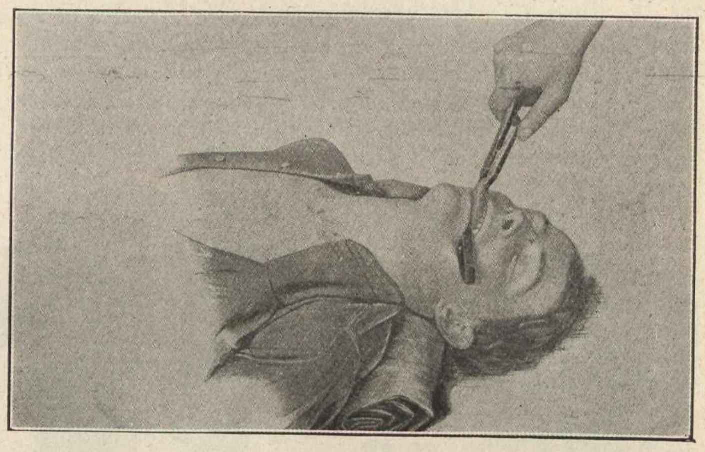


Fig. 4.—Method of Inserting Block in Mouth.

acting as follows: Carry the patient immediately into fresh air, place him on his back, on a flat surface, with a coat rolled (not folded) under the shoulders and neck, in such a way as to allow the head to fall backward enough to straighten the wind-pipe, as shown in Fig. 2; at the same

Fig. 5.—Forcing Air Out of Lungs.

time open the shirt wide at neck and loosen the trousers and drawers at waist, and have an assistant rub his legs hard.

(The sleeves and trouser legs should be rolled up as far as possible, so that the rubbing may be done on the bare skin, and the shirt and undershirt should be torn down the

Fig. 6.—First Movement in Artificial Respiration.

front so that they may be thrown back, leaving the chest and stomach bare, as shown in Fig. 10.)

Open his mouth, forcing the jaw if necessary.

(If the jaw is rigid it can be forced open by placing the forefinger back of the bend of the lower jawbone and the thumbs of both hands on the chin, pulling forward with fingers and pressing jaw open with thumbs, as shown in Fig. 3.)

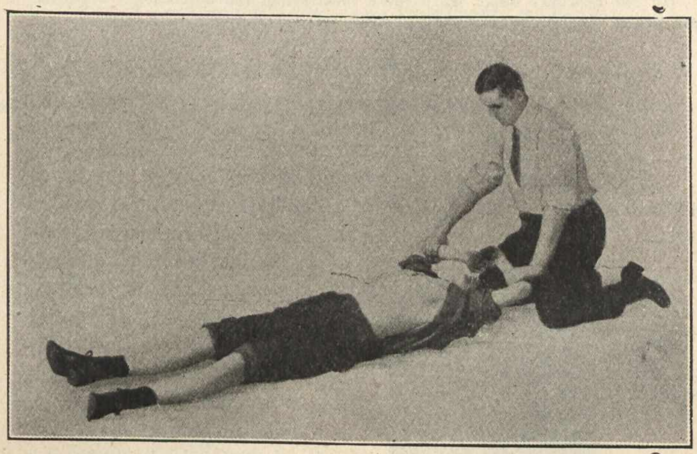


Fig. 7.—Second Movement in Artificial Respiration.

Place something (piece of wood shown in Fig. 1) between the teeth to keep the jaws open and to prevent the patient biting his tongue, using something large enough to prevent any danger of his swallowing it accidentally; grasp the tongue with the tongue pliers, as shown in Fig. 4, hav-

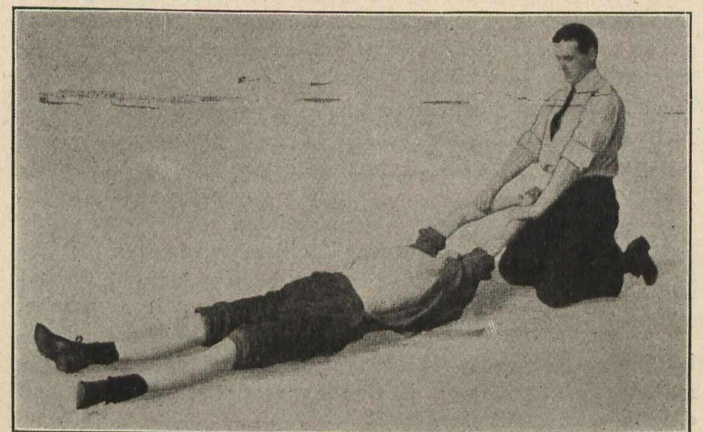


Fig. 8.—Third Movement in Artificial Respiration.

ing an assistant hold it out while you are helping the patient to breathe, as described below.

(In the absence of tongue pliers, the tongue may be grasped between the index and second fingers, after they have been covered with a handkerchief.)

Clear froth from the mouth by putting in your forefinger

Fig. 9.—Fourth Movement in Artificial Respiration.

as far as possible and bringing up the froth with a scooping motion. Have the assistant who is holding the tongue slowly pass the bottle of ammonia, with sponge attachment, under the patient's nose about once a minute when the patient is breathing in, and when his arms are extended above his head, as shown in Fig. 10.

While you are preparing the patient as just described, an assistant should force the air out of the lungs by pressing the base of the ribs together about once every four seconds, as shown in Fig. 5. Do not press vertically, but press on the patient's side (palms of hands over lower ribs) in such a manner as to force as much air out of the lungs as possible.

After the clothing has been loosened, the jaw forced open, as shown in Fig. 4, the froth cleared from the mouth and the tongue grasped, begin artificial breathing at once as follows:

Artificial Breathing.

Kneel far enough behind the head of the patient to prevent interference with the man holding the tongue. Bend

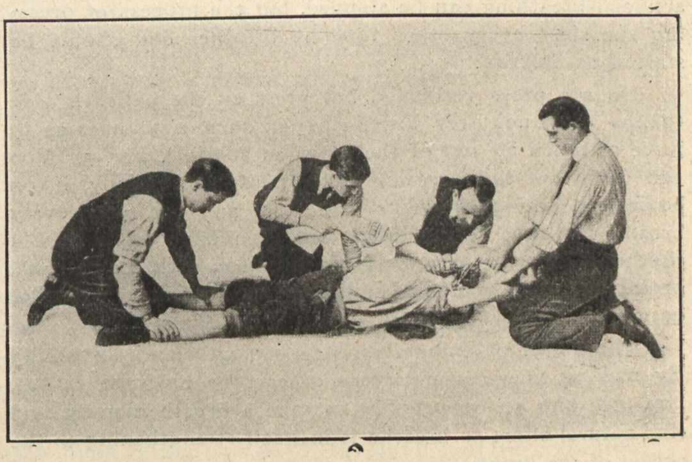


Fig. 10.—Position of Assistants.

the patient's arms so that the hands meet on the chest; grasp the patient's forearms firmly, as close as possible to the bent elbows.

1. Firmly press the patient's elbows against the sides of his body so as to drive the air out of the lungs, as shown in Fig. 6; then

2. Raise the arms slowly with a sweeping motion until the patient's hands meet above (or behind) the patient's head, as shown in Fig. 7; then

3. While you have the patient's arms stretched out in line with his body, give them a slow, strong pull, until you have expanded or raised his chest as high as it will go, as shown in Fig. 8; then

Fig. 11.—Treatment After Patient Becomes Conscious.

4. Bring the arms, with bent elbows, down against the sides, and press them firmly as before, as shown in Fig. 6.

This action should be continued about fifteen times a minute until the patient begins to breathe. You must guard against a tendency to make these motions too fast; they must be done slowly. A good plan is to count four slowly —"one," as the pressure is given on the sides, as shown in Fig. 6; "two," as the arms are being extended above the head, as shown in Fig. 7; "three," as the strong pull is given, as shown in Fig. 8, and "four," when the arms are again being bent and returned to the sides, as shown in Fig. 9.

Do not let your hands on the forearms slip away from the elbows; the best result comes from grasping close to the elbows, as shown in Fig. 9.

The operator must appreciate the fact that this manipulation must be executed with methodical deliberation, just as described, and never hurriedly or half-heartedly. To grasp the arms and move them rapidly up and down like a pump handle is both absurd and absolutely useless.

Each time the arms are pulled above the head and the chest expanded, the assistant who is holding the tongue should pull the tongue out and downward, and another assistant should, from time to time, slap the chest with a towel or cloth wet with cold water, as shown in Fig. 10.

When the patient is breathing by himself, the process of artificial breathing can be stopped, but the process of pressing the sides every other time he breathes out, should be started as follows:

Do not press vertically, but press on the patient's side (palms of hands over lower ribs) in such a manner as to force as much air out of the lungs as possible, Fig. 5. You can carry out this pressing action most successfully, if, on beginning, you move your hands in and out with every breath, pressing very lightly, until you have established a rhythmical motion of your hands in unison with the patient's breathing; then you can begin to press hard at every other outgoing breath.

(The object of doing this is to strengthen his breathing By making the pressure every other time he breathes out, you give him an opportunity to take a breath himself, and this natural effort to breathe is in itself strengthening to the action of the lungs.)

Continue this pressing action until the man is conscious and breathing well by himself.

The rubbing of the legs and arms should continue as long as the artificial breathing, or pressing action, is necessary, and the holding of the tongue, and the passing of the bottle of ammonia with sponge attachment under the nose, as long as he is unconscious, as shown in Fig. 5.

After he becomes conscious, give him a half teaspoonful of aromatic spirits of ammonia in a third of a glass of water. After you have brought him around, surround him with bottles of hot water.

(Beer bottles are easily obtained, and should be filled with hot water and covered with a paper or cloth to prevent burning the flesh. Hot bricks, also covered, or gas bags filled with hot water will answer as well.)

Then cover him with a coat and watch him. See Fig. 11.

In performing artificial breathing, if the patient does not show any signs of coming to life promptly, you should not be discouraged, but should continue the motions regularly for at least an hour, summoning such assistance as you may need. Cases are known where patients showing no signs of life after an hour's work have still recovered, and their recovery was due entirely to the faithful persistence of the person in charge.

Persons shocked by electricity need fresh air; therefore, bystanders should not be permitted to crowd around a patient, and no one should be allowed to approach him except those carrying out these instructions.

The recovery of a person unconscious from electric shock may be hastened by the use of oxygen, which should be administered at the discretion of the doctor.

Burns Caused by Electricity.

Electric shocks are often accompanied by various types of burns, which should be treated as follows:

Have the injured attended by a doctor as soon as possible. In the meantime cover the burned surface with cotton, saturated in a strong solution of bicarbonate of soda and water (as much soda as the water will absorb), and then wrap with light bandaging. In the absence of soda, carron oil may be used in the same manner.

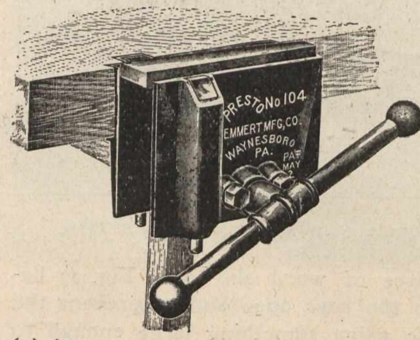
(Even apparently slight burns should be treated by a doctor, as the injuries are likely to prove more serious than those resulting from ordinary burns.)

Should the articles contained in the company's emergency kit for electric shock cases not be on hand when needed, after sending for a doctor, every effort should be made to revive the patient, by following the course of movements described until the doctor arrives and the necessary articles are secured.

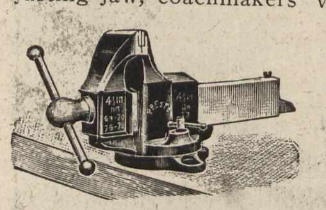
[In our February issue, we purpose illustrating and describing "First Aid" practice at the Canada Foundry Company's Davenport Works'—Editor.]

QUICK-ACTING VISES.

The accompanying illustration shows two of the latest patent vises. The first is a quick-setting cabinet-makers' vise. These are devised to be fastened underneath the bench, and are adapted for the holding of every description of woodwork. Attention is called to the following special features: (1) The planed jaw surfaces, which make it a closer fitting vise than any other; (2) its length of beam, which permits it to open 14"; (3) its power to grip at any point between 0 and 14 inches; (4) its possibility for continued screw pressure of one-half inch after gripping the work; (5) its adjustable holding pins; the efficiency of which may be increased by an additional pin in the bench plank; (6) its self-adjusting loose jaw, suitable especially for tapered work.



The second illustration shows a quick-acting, self-adjusting jaw, coachmakers' vise. The rear jaw of this vise is self-adjusting, and in use automatically conforms to any angle, adjusts itself and holds firmly the object whether it be straight, beveled, or wedge-shaped; thus making it a parallel solid jaw vise. The self-adjusting jaw resting and working as it does upon, and against the solid body of the vise, is thereby rendered as strong and durable as a solid jaw.



These tools are manufactured by the Emmert Manufacturing Company, Waynesboro, Pa., U. S. A.

KEEP A-GRINNIN'.

If troubles come an' sorrows, too,
As life's silk thread you're spinnin,'
Just throw 'em off an' don't get blue,
An' keep right on a-grinnin'.

There aint no use a-bein' glum,
Cuz other folks are winnin';
Git up an' push, an' you'll win, too,
So keep right on a-grinnin'.

The Lord aint bin no worse to you,
Than others who've been sinnin';
You've got stack-loads to thank him fer,
So keep right on a-grinnin'.

Don't let the troubles of last year
Spoil this from its beginnin';
A little leaven spoils the lump,
So keep right on a-grinnin'.

Make every season of this year
Pure white with Char'ty's linen,
And every one will love you more
Fer keepin' on a-grinnin'.

— F. B. UTLEY, of Galt.

The Canadian Engineer.

ESTABLISHED 1893.

With which is Incorporated

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TORONTO, CANADA, JANUARY, 1906.

CONTENTS OF THIS ISSUE.

1905: A RETROSPECT.

In many respects the year 1905 was a period of great achievement in Engineering. Enterprises were started in Canada, which are viewed by her people with pardonable pride: the great water-power development at the Horseshoe Falls, Niagara, for supplying electricity to distant Toronto and other cities; the Quebec bridge, which, when completed, will be the largest single span cantilever structure in the world; the trans-continental Grand Trunk Pacific Railway, for opening up the wide prairie lands of the North-west to the blessings of civilization; the fine rolling mill at Sydney, Cape Breton, for supplying Canadian railways with home-made steel rails; and the experimental electric furnace, ore smelting plant, installed by the Canadian Government at Sault Ste. Marie, for the purpose of proving the possibility of reducing the refractory iron ores of the Dominion. These, and other important works of Canadian Engineers, have made memorable the year just ended. When we look out of ourselves over the mechanical world, we see footprints and marks everywhere, of a great commercial struggle between steam, gas, electricity, and oil, for supremacy as a motive power. It is 207 years since James Watt invented the reciprocating steam engine, the practical application of which—on both land and sea—has done more to accelerate progress and civilization than any other material agency of man. Nine years ago, when we compared a modern quadruple expansion, marine type, reciprocating steam engine, with its perfection of design and finish, and economy in steam consumption, side by side with the rudely designed and roughly constructed engines of the Watt period, we were filled with admiration at the progress made in constructive Engineering, and it seemed that finality had just about been reached in the application of steam as a motive power. In 1897, however, as the battle-ships of Great Britain lay off Spithead, in two lines five miles long, celebrating the jubilee of Queen Victoria, the representatives of all nations were startled to see a small steam launch—the "Turbinia"—dash before their eyes between the two lines of ships, at a terrific speed (32¾ knots)—the like of which had never been seen on water before. That was the first popular demonstration of the Parsons turbine. Astonishing progress has been made since then. It is estimated that there is now about 700,000 indicated horse power of marine turbine machinery built or being built. Orders have been issued by the Admiralty for its adoption throughout the British navy; and a similar course would doubtless have been taken by the U. S. Navy, had the contemplated action not been checkmated by the gross misrepresentations of a powerful German syndicate; an incident which stands out as one of the greatest commercial scandals of 1905. The last month of the old year witnessed the complete triumph of the steam turbine on the leviathan Cunarder, the R.M.S. "Carmania," which sailed from New York, December 16th on her second voyage, having on board our special correspondent, Mr. C. H. Mitchell—who is to record his impressions in our February issue. The "Carmania" has proved that the steam turbine is an ideal prime mover for ocean vessels of even the largest size. The passing of the reciprocating steam engine for marine propulsion, is, therefore, only a matter of time. But the old year has not rendered a like verdict in the case of the stationary land engine; for although the steam turbine has proved its suitability as a prime mover in electric lighting plants of magnitude, etc., there are fields where the reciprocating type of steam engine will hold its own for many a long day; in huge rolling mills for example, where the rolling of heavy steel slabs and blooms demands an enormous sudden torque, or turning effort. No steam turbine yet designed can be governed to meet this severe, erratic work. And since Professor Rateau, of Paris—by his invention of the low-pressure turbine generator—has made it possible to utilize the exhaust steam from reciprocating engines, converting the rejected heat into useful electrical power, it is certain that costly first-class, reciprocating engines, in plants of magnitude, will not—on the score of economy—be suddenly torn out, and steam turbines substituted in place thereof.

Another phase of Engineering that showed a marked advance during the year, was the gas engine business; due not to the invention of any new type, but largely to the introduction of individual suction gas producer plants, by which a still further economy in fuel consumption has been effected; the comparative efficiency of this system as against the best reciprocating steam engine practice being 2 to 1. The installation of suction gas producer engine plants is destined to become very popular—especially for low powers. Perhaps the most formidable rival to the gas engine system that the past year has shown, is the oil engine of the Diesel type, which has been brought to a high degree of perfection. And it is worthy of note, that the British Admiralty have adopted it for marine work on all pinnaces and smaller light craft. In the electrical world, the events of the year have centred largely around the electrification of suburban railways, and the advent of the electric locomotive. In this enterprise, as in the case of the steam turbine, Great Britain has led the way. The 150-ton electric locomotives now running on the Metropolitan Railway, London, have proved an unqualified success, as also have the 65-ton storage battery locomotives running in Yerkes underground electric railway, between Piccadilly and Brompton, London. Based largely upon English experiments, the electrification of the Temiskaming Railway in Canada was decided upon last summer. And during 1906, it is fully expected that work on this great enterprise in hydro-electric traction, will be commenced.

Viewed from the standpoint of the Engineer, the year 1905 has been remarkable for its forward movement in the displacement of the old types of reciprocating steam engines. And although there are lines of work in manufacture and industry, where the engine invented by James Watt will still have a place, the merest tyro in science must perceive that the passing of this type of engine for general purposes is only a matter of time.

Fraser and Chalmers, Limited, London, England, made a net profit of $140,271 for the year ending June 1905; the income was reduced, as the Allis-Chalmers Company, of Milwaukee, Wis., U. S. A., passed its preference dividend, **having spent its profits in laying down plant for the economical manufacture of electrical machinery, steam turbines, gas engines, etc., to meet the demands of the new era.**

Our advice to Canadian Engineering firms generally is, "Go ye and do likewise."

* * *

Negative Side of Mechanical Engineering.

In the technical world, no yearly document is looked forward to with greater interest by responsible Engineers, than the annual report of the British Engine, Boiler, and Electrical Insurance Company, Limited, edited by Mr. Michael Longridge, whose name as a critic in constructive Engineering is synonymous with competence and thoroughness. In the last annual report a startling feature is the record of high percentage of failure of electric dynamos and motors due to old age or deterioration. One out of every twelve dynamos insured, broke down during the year, and one out of every 9.3 motors. The application of electricity to driving in factories is so recent, that in the order of things, none of these can yet be old, yet the facts are, that 38 per cent. of the dynamos, and 25 per cent. of the motors which failed, were worn out. Side by side with these breakdowns, is the recorded failure of a reciprocating steam engine, which had been running faithfully for some 70 years! Another line of experience is in the failure after failure of steam engines, caused by overload. Designed for 60 lbs. pressure, they have been subjected to pressures of 130 lbs., and more, in order to meet the quickened speed of machines due to keen competition and the introduction of higher grade cutting tools. The flat surfaces intended to carry 50 or 60 lbs. will not stand 160 lbs., hence failure; followed by characteristic English patching, and consequently repeated breakdowns. "Engineering," (London), commenting on this dangerous practice—especially in the matter of boiler failures for like cause—is disposed to question the honesty and integrity of builders who undertake these repairs. The report shows that one boiler was actually covered with patches put on with bolts, and made tight with cement! Mr. Longridge insists that the headers of Babcock and Wilcox boilers should be removed annually for examination. He cites a case in proof of this need. A boiler was examined in 1902, when only a few doors were removed at selected points. In 1903 a thorough inspection was made, and serious corrosion was discovered at the places where the outside dogs or caps were bedded. In 1904 this oxidation had increased so rapidly that the metal was only ⅛" thick in places. The report bristles with important facts like those indicated, accompanied by suggested remedies. It is interesting to note that most of the failures in prime movers are in slow-speed engines; modern high-speed engine failures being conspicuous by their absence. Valuable object lessons are presented in the shape of defective valve gear, and connecting rod bolts, with a luminous and profitable discussion of fibre stress and reliable factors of safety. And not to be despised are the recorded trial tests of the celebrated Cole, Marchant, and Morley marine type compound engine, (258 H.P.), operating with superheated steam, at a steam consumption of 8.682 lbs. per hour, which data are supplemented by some critical inductive reasoning on the ultimate value of superheated steam; and these invaluable steam engine data are followed by scientifically tabulated data on the trial tests of effective work done by a 634 H.P. triple cylinder Diesel oil engine, which developed 163.3 horse-power, with an oil consumption of 0.28 lbs. of oil per horse-power hour, converting the same into a mechanical equivalent of 45 per cent. of the total heat value of the fuel. Lack of space will not permit a more extended notice of the contents of this invaluable report, but in laying it down, we have no hesitation in declaring our conviction, that it is the most important *practical* document issued in the domain of Mechanical Engineering during the year 1905.

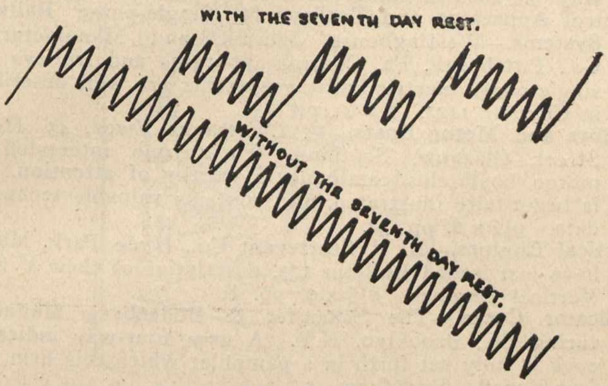
* * *

Rocks Ahead in Structural Engineering.

During the past year, wrought iron, stone and concrete, have been coming into increasing favor, owing to the alleged rapid decay of steel structures through corrosion. Certain of the great railway corporations in the United States have firmly declared against steel-built bridges, etc., and in favor of the erection of stone and concrete structures, wherever possible. Farmers out West say that their wire fences are done at the end of *three* years, whereas their old material used to last *thirty* years. The rapid deterioration of steel wire nails and steel plates, coated with tin and used for roofing; steel boiler tubes, etc., is a matter of notoriety. We were astonished to notice in an Ottawa factory building a week or two ago, concrete and wood applied, where a few years back, steel sections would have been used almost exclusively. It is quite evident, that unless some process is discovered of thwarting the destructive action of corrosion on exposed steel structures, a serious check will be given to the thriving industry in steel manufacture. The Canadian Government has wisely undertaken at Sault Ste. Marie to try and utilize our refractory ores for the manufacture of iron and steel; why not supplement this by scientific experimentation on the best method of arresting the oxidation and corrosion of steel after it is made and applied?

The Rule of Seven. The chart of Dr. Haegler,of Basle, Switzerland, ought to be as familiar in education as the rule of three; for this "rule-of-seven" is more radically essential to wise living. Each downward stroke represents the vital energy expended during a day's work, which is not quite compensated for by the upward restorative stroke of the night's rest; so that one is a little weaker every morning, a little wearier every night, as the week's work goes on.

Take the case of a laborer: a normal day's work overdraws his storage of oxygen one ounce; but a



Rule-of-Seven Diagram

normal night's rest restores only one-sixth of it. Losing one-sixth of an ounce per day, he is six-sixths of an ounce short on Sunday morning, a whole ounce short, a whole day behind—in the same condition physically on Sunday morning, in the same need of rest, as on the previous Monday night. He is called, therefore, to a whole day's rest in order to balance his account with Nature. If he habitually disobeys this physical law of weekly rest, he "runs down" more and more until he is as far from what he ought to be as is shown by the chart. Upon this point physiologists are agreed. We breathe less oxygen and use more during ordinary work than when at rest. Absorption of mind checks respiration to the extent of about 12,960 cubic inches in eight hours. Oxygen being only another name for *vital force*, the bearing of the foregoing induction on the matter of health and endurance is manifest. And since success in life depends largely upon a man's reserve of vital energy, enabling him to meet stress and strain when the flood tide in his career comes, it behoves every young Engineer on the threshhold of a New Year, to consider seriously this inexorable "rule-of-seven."

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Grain Elevator Controversy. A Fort William correspondent, signing himself "A. W. Davidson, M.E. for thirty-five years,"—who is evidently a diligent reader of our journal, and does it on the cheap, since he is not on our subscription list,—takes strong exception to the statement of facts contained in our November issue, relative to the deplorable collapse of grain elevator "D" at Fort William, and supplements his *tu quoque* defense with a scurrilous attack on the author of "Grain Pressures in Deep Bins." We have no objection to opening our columns to an intelligent, socratic discussion of this deeply interesting subject, and if the Steel Storage and Elevator Construction Co., of Buffalo, U.S.A., whose foreman "A. W. D." is, care to make an attempt to refute the allegations made in our November number, we shall be pleased to accommodate. It is a question of Canadian *versus* American grain elevator design and construction. Our "M.E. of thirty-five years' standing," is manifestly incapable of holding up the American end, and even if he was, his "prairie" method of conducting a technical controversy would rule him out of court.

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BOOK REVIEWS.

Secrets of the Rocks.—A story of the hills and gulches. A manual of hints and helps for the prospector and miner. By S. M. Frazier, San Francisco; Mining and Engineering Review. Size 5¾"x8"; 432 pp. (Price $1.60.)

As indicated on the title page the author shows "where and how to search for gold and silver mines, and how to make simple, general and special tests for minerals and metals." In these days any man of spirit in Canada—guiltless of possessing wealth—is liable to pack his grip and start for the El Dorado's which are being opened out in the great forest lands of the far North. A book like this in the hand, dealing **practically** in a plain, lucid, attractive manner, devoid of undue technicality, with the sciences of petrology, mineralogy, inorganic chemistry, and metallurgy, will be an invaluable guide to the adventurous prospector, and even to the Engineer trained in geological survey, since it records the hard-earned experience of one who has delved in the hills and gulches and discovered their secrets. As he says in the preface, every "prospective prospector ought at least to know enough about geology and mineralogy to recognize a mineralized rock when he sees it. Fortunes and lives have been sacrificed in the search for mineral veins, where in the economy and arrangement of the earth's crust they could not possibly exist. And many valuable prospects have been abandoned or sacrificed because the discoverers did not know what they had found." This is one of the most interesting, and at the same time, profitable, books, that we have read for many a day.

Hydrographic Surveying: Methods, tables and forms of notes. By Samuel Hill Lea, M. Am. Soc. C. E., consulting engineer. New York: The Engineering News Publishing Co., 1905. Size, 9¼" x 6⅜". 172 pp. (Price $2.00, net.).

"The term Hydrographic Surveying is applied to surveys of rivers, lakes, canals, and other bodies of water. Under this head should be included survey of water sheds and drainage areas; also surveys of basins or reservoirs for the storage of water on a large scale." With this clear and comprehensive definition begins the manual before us, and the author elaborates imaginary hydro-surveys, with expert knowledge of the use of transit and stadia; makes soundings, measures scientifically the flow of streams, describes general field and office work, aided by a wise use of graphics, and some 99 illustrations: and all this is done with an absence of abstruse mathematics, and a literary style of Spartan-like simplicity; and at the same time with a thoroughness of treatment, altogether commendable. The manifest practicality of the book is the result of the author's wide practice in professional work: and in this respect, complies with the modern dictum, that technical text-books should be written by Engineers—in practice. Exceedingly interesting to the uninitiated are the chapters on double floats, and current meters for determining the velocity of flow of streams. We should not be surprised to find this text-book widely adopted as standard in technical schools, and institutions where practical methods of Civil Engineering are taught.

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BLUE BOOK NOTICES.

Mica.—A report written by Fritz Cirkel. M.E., Montreal. has been issued by Dr. Eugene Haanel. Superintendent of the Mines Branch of the Department of the Interior. This report deals with mica: its occurrences. exploitation. and uses: and is announced as the first of a series on the economic minerals of Canada. 6½ x 9½, pp. 130.

Tide Tables.—Tide tables for Quebec, Father Point, Halifax, and St. John, N.B., for the year 1906 have just been issued by the Tidal and Current Survey in the Department of Marine and Fisheries. This report gives the tidal differences for the Gulf and River St. Lawrence, Nova Scotia, the Bay of Fundy, and information on currents. 6½ x 9½, pp. 30.

Reports of the British Tariff Commission.—Volume I.: The Iron and Steel Trades. This report gives in detail the results of the enquiry into the iron and steel industry, together with provisional conclusions which have been reached. The final conclusions will not be published until the Commission has completed its enquiry into the other trades. 8½ x 12, pp. 100. Volume II.: The Textile Trades. Part I.: The cotton industry, giving statistics of the world's cotton industry in detail by charts and tables. Much valuable information concerning the cotton trades is contained in this report. 8½ x 12, pp. 100. Published by the Tariff Commission, 7 Victoria Street, S.W., London.

The Annual Report of the Chief of the Bureau of Steam Engineering, Navy Department of the United States, Washington, D.C., has just been issued. This report covers the operations of the Bureau during the fiscal year ending June, 30, 1905, together with estimates for the fiscal year ending June 30, 1907. A register of the vessels in the United States Navy is included. 5¾ x 9, pp. 60.

Reports of the Bureau of Mines.—In a report of the Bureau of Mines, Part II., which has just been published, Prof. Willett G. Miller, Government Geologist, embodied the results of his recent surveying trip in the cobalt and silver mining fields of the Lake Temiskaming region. The report is an exhaustive one containing some sixty pages of very interesting information, profusely illustrated from photos taken during the trip. 6½ x 9¾, pp. 65.

The fourteenth Annual Report of the Bureau of Mines has just come to hand. Exhaustive statistics of the mineral production of the Province of Ontario are given, together with those of the cement industry. A description of the silver cobalt ores of Lake Temiskaming by Prof. Willett G. Miller, Provincial Geologist, and a monograph on the Sudbury nickel region are contained in this report. 6¾ x 9¾, pp. 374.

CATALOGUES AND CIRCULARS.

Motor-Generators.—Canadian Westinghouse Co., Limited, Hamilton, Ont. Circular 1119 describes the various types of motor-driven generators, which are shown by half-tone engravings. 7 x 10, pp. 12.

Steam Hoisting Engines.—C. W. Hunt Co., West New Brighton, N.Y. Illustrated catalogue No. 058 is descriptive of hoisting engines of unusually massive construction, especially designed for heavy duty in continuous service. 6½ x 9¼, pp. 36.

Advertising Agents.—John Haddon & Co., Salisbury Square, London, E.C. Messrs. Haddon, in a very artistically gotten up catalogue, announce the visit of their Mr. Walter Haddon to New York. Mr. Haddon's address while in New York will be 31 West Thirty-first Street, New York. 7 x 10, pp. 8.

Machine Tools.—In "Progress Reporter" the Miles-Bement-Pond Co., 111 Broadway, New York, endeavor from month to month to keep those interested informed as to the new machines which they are constantly placing on the market. 13 x 9, pp. 8.

Motor-driven Air Compressors.—National Electric Co., Milwaukee, Wis. Bulletin No. 363 describes and illustrates stationary and portable motor-driven air-compressors for continuous and intermittent service. 7 x 10, pp. 8.

Coal-handling Machinery for Mines.—The Jeffrey Manufacturing Co., Columbus, Ohio. Coal-handling appliances of all kinds are described and artistically illustrated in catalogue No. 20. 6 x 9, pp. 142.

Asbestos.—The Canadian Asbestos Co., Montreal, issue a popular monthly, setting forth the advantages of asbestos for pipe covering, gland packing, paint, etc. The text is interspersed with bright literary gems. No. 9, Vol. I. 8¾ x 6, pp. 10.

Locomotives.—American Locomotive Co., New York. The Mallet articulated compound locomotive is described in detail, and pictured, in a catalogue which has just been issued. 9 x 6, pp. 32. The same company have also just issued a similar catalogue describing the Cole four-cylinder locomotive. 9 x 6, pp. 36.

Polyphase Induction Motors.—National Electric Co., Milwaukee, Wis. These motors are fully set forth in Bulletin No. 350.

Electric Switches.—The Hill Electric Switch Co., Limited, Montreal, Que. Bulletin No. 105 shows various kinds of knife switches, and indicates prices of same. 6 x 9, pp. 16.

Door Checks.—The Yale & Towne Manufacturing Co., New York, N.Y. "The Peacemakers" is the title of a daintily printed and illustrated little story, setting forth the advantages to be derived from the use of "Blount Door Checks," 5 x 6, pp. 16.

Engineers' Supplies.—The Canadian Fairbanks Co., Montreal, Toronto, Vancouver, and Winnipeg, describe the many engineering specialties which they sell in a monthly publication, called "The Fairbanks Standard." 6 x 9, pp. 16.

High-speed Enclosed Steam Engines.—The Boston Steam Engine Co., 246 Summer Street, Boston, Mass. A pamphlet describing high-speed engines, especially suited for electric generating sets. 6¼ x 9¼, pp. 4.

Coal Conveyors.—C. W. Hunt Co., West New Brighton, N.Y. "Hunt" Automatic Railway is the title of a fine catalogue, which graphically pictures the "automatic railway" as used in numerous coal plants. 6½ x 9¼. pp. 30.

Control Apparatus and Trolleys for Single-phase Railway Systems.—Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa. Control apparatus and trolleys for single-phase electric railway systems are well described in Circular 1127. 7 x 10, pp. 15.

Motors and Motor Boats.—C. L'Estrange Ewen, 45 Hope Street, Glasgow, Scotland. To anyone interested in motor boats this catalogue is worthy of attention. It is beautifully illustrated, and contains valuable technical data. 9¼ x 6, pp, 32.

Vertical Engines.—B. F. Sturtevant Co., Hyde Park, Mass., have just issued Bulletin 125, descriptive of their V. S. 5 Vertical Engines. 6½ x 9, pp. 8.

Indicator Cocks.—The Schauffer & Budenburg Manufacturing Co., Brooklyn, N.Y. A new four-way indicator cock is fully set forth in a pamphlet which this firm has just issued. 6 x 9½, pp. 4.

Guide for Buyers.—A list of the leading British manufacturers and merchants, published by "Commercial Intelligence," 166 Fleet Street, London, E.C. 5½ x 7¾, pp. 52.

Steam Turbines.—Westinghouse Machine Co., East Pittsburgh, Pa. A booklet giving the names of users of the Westinghouse-Parsons turbine. 4 x 7¾, pp. 4.

Roller Bearings.—Canadian Bearings, Limited, Hamilton, Ont. The products of this new company are well illustrated and described in a catalogue which they have just issued. 4¾ x 7½, pp. 32.

Gas and Gasoline Engines.—The Temple Pump Co., Chicago, Ill. Copious illustration and lucid description set forth the manufactures of this company in a readable catalogue. 5¾ x 8½, pp. 24.

Calendars, 1906.—The B. Greening Wire Co., Hamilton, Ont., have again issued their annual calendar. This one for 1906 is quite up to their high standard. It is artistically designed and the date figures legible, while the tables and technical data on wire ropes, etc., are invaluable. Send for one.

CORRESPONDENCE.

"TURBINIA."

Editor The Canadian Engineer:

Knowing your interest in comparisons between turbine and reciprocating engines, I have pleasure in submitting account for the season of 1905.

Total coal bought, 4,125 tons, 2,000 lbs. per ton.

Night and Sunday firing: 1,056 tons, ship lying at her dock, Hamilton; 132 tons, ship lying at her dock, Toronto.

Total coal consumed while lying at dock, 1,188 tons.

Total coal consumed while running, 4,125-1,188 = 2,957 tons.

(This is for all purposes; pumps, electric light, engine, etc.)

Total number round trips, 338. Distance, 78½ miles.

Coal per round trip, 8.7 tons.

Miles per ton of coal, 9.1 short tons; 10.19 long tons.

Considering the ship runs steady two miles above her calculated speed, and estimated at the H.P. necessary for her calculated speed, viz., 33.50 with 2.175 tons being burnt per hour, from above, gives 1.301 lbs. of coal per 5 H.P. per hour.

ALBERT WHITE,

Chief Engineer S.S. "Turbinia."

December 17th, 1905.

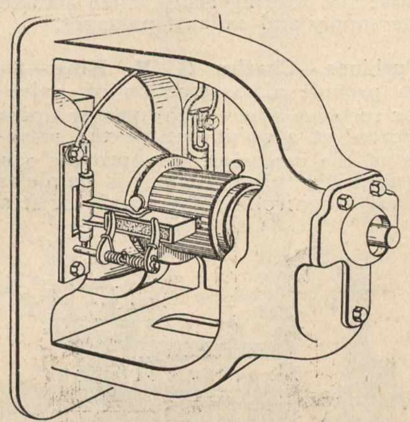
[**Note.**—The "Turbinia" is now doing passenger service between Kingston, Jamaica, and Santiago, Cuba.]

INTERNATIONAL PATENT RECORD

CANADA.

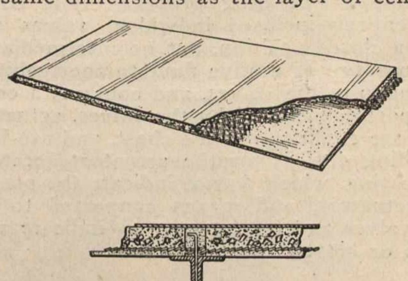
Specially compiled by **Messrs. Fetherstonhaugh and Dennison,** Patent Attorneys, Toronto, Montreal, and Ottawa.

Brush Holder for Electric Generators.—Isidor Deutsch. —This device was designed specially for train lighting purposes, though it is of general applicability. The chief characteristics consist in journalling a pair of parallel arms on the frame of the machine, so that they will move parallel to the commutating claim. The bearings, therefore, are disposed substantially at right angles to the axis of the commutator. The box containing the brush is pivoted between said parallel arms and spring fingers secured on a rod ex-

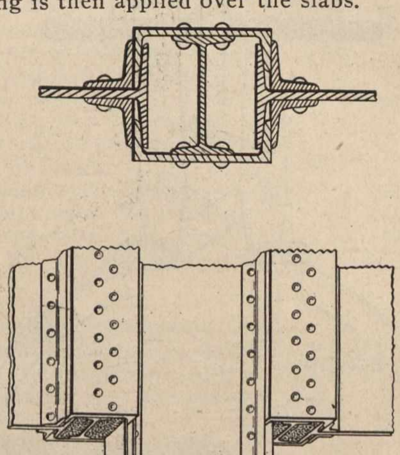


tending from the frame of the machine engage the back of the brush in the box and hold the same in engagement with the commutator.

Composite Roofing.—The salient features are the combining of cement and expanded metal in the slab, and the method of fastening. The slab is composed of a sheet of expanded metal, superimposed on a layer of cement and extended at each end thereof, together with a layer of concrete of the same dimensions as the layer of cement, super-



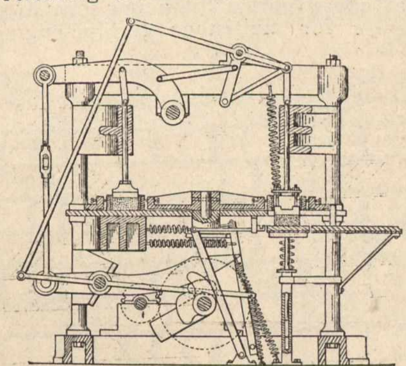
imposed on said sheet of expanded metal and lower layer of cement. In applying the invention, the projecting ends of expanded metal of the different slabs over-lap one another, and a rod having hook ends, projects upwardly from between the angle iron beams through said over-lapping ends. The space between the slabs is filled with cement submerging the upper portion of the hooked rod, and a suitable waterproof covering is then applied over the slabs.



93645

Metallic Roofing.—William Hunter.—93,645.—The essential features are upright columns formed of beams with inturned flanges and connected together by an I-beam, and I-beams joining adjacent columns together. Two channel beams are connected together by means of an I-beam, thus forming a column with open sides. An I-beam is inserted with the flange inside the inwardly extending flanges of the channel beams, and connects two of the columns together and closes the open sides. Angle irons are secured either on the channel beams or on the web of the I-beam which connects the columns to hold the I-beams securely in place. The hollow column thus formed is filled with a concrete mixture.

Brick-making machine. Horace G. Smith.—93,668.—The invention consists of a set of moulds arranged radially upon a central revolving table. which operates above a stationary table. A set of cams and levers, power driven, operate a compressing block at the forward end of the table and a releasing block at the rear. There is a recess



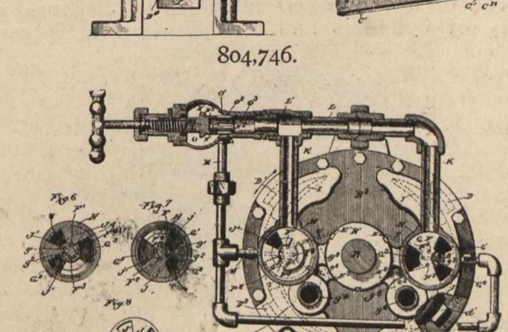
93668

formed in the rear portion of the table, with a spring held bottom closing said recess. When the formed brick is pressed downwards from its mould a suitable cam and lever operate a push arm to remove the brick from its position on the spring held portion of the table, after which the said table is allowed to resume its original position.

UNITED STATES OF AMERICA.

Specially selected and abridged by **Messrs. Siggers and Siggers,** Patent Attorneys, 918 F. Street, N. W., Washington, D. C., U. S. A.

Rotary Engine.—Herbert M. Lofton.—804,746.—An improvement in rotary engines. It consists of a piston having eight radially-moving blades, the casing having its rim provided with opposite concentric portions fitting the piston circumferentially for a length equal to the distance between the centres of any two adjacent blades, and with opposite concentric operating-sections between the said piston fitting concentric sections, said concentric operating-sections being of a circumferential length equal to the distance between



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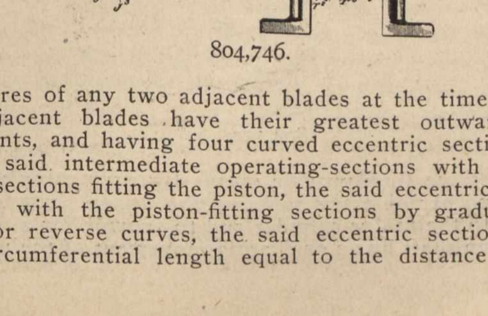
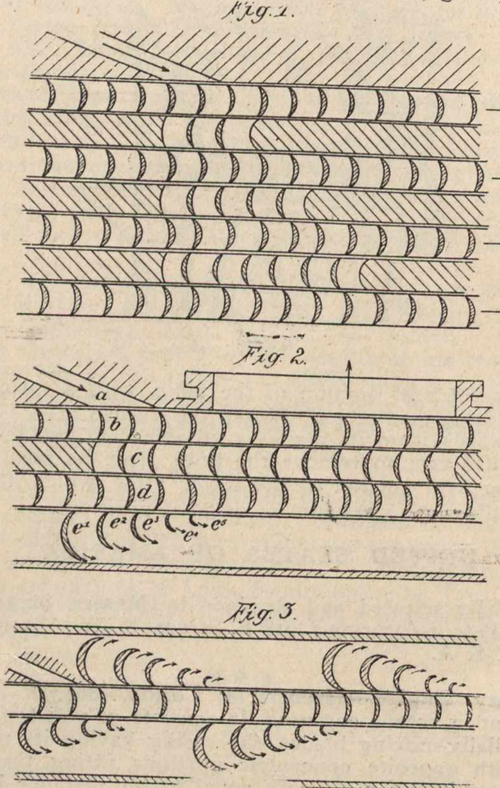


804,746.

the centres of any two adjacent blades at the time the said two adjacent blades have their greatest outward radial movements, and having four curved eccentric sections connecting said intermediate operating-sections with the concentric sections fitting the piston, the said eccentric sections merging with the piston-fitting sections by gradual compound or reverse curves, the said eccentric sections being of a circumferential length equal to the distance between the centre of any two adjacent blades at the time the said blades may be covering this portion of the casing, the casing being provided with heads at each end, the said heads having ports opening opposite the eccentric sections, the said ports being of a circumferential length equal to the circumferential length of the said eccentric sections, and the rim of the casing being provided with ducts connecting the opposite ports in each head.

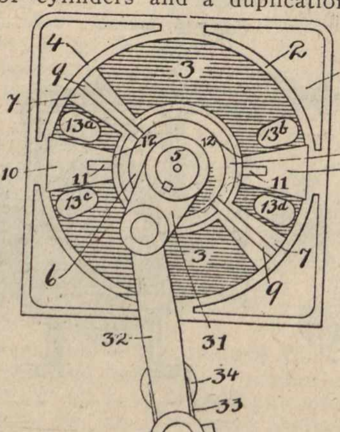
Turbine Engine.—Hugo Lentz.—804,541.—Relating to turbine-engines, including steam-turbines and gas-turbines. The improvements consist in providing new combinations and arrangements whereby economy is secured in manufacture as well as in operation of the turbine-engine. Generally speaking, there is provided, (1), a new form of nozzle giving increased effectiveness; (2), a new form of guiding and redirecting device for multistage turbine-engines; (3), a



804,541.

new arrangement of parts whereby a turbine-engine employing but one wheel may become a multistage engine; (4), a new arrangement in guideways or directing channels for turbine engines whereby losses due to eddy-currents and friction in the guideways or channels are minimized or eliminated; (5), a new arrangement of confining devices whereby the casing of the turbine-engine is protected from the direct heating action of the jets of pressure medium; (6), new combinations of said parts, whereby the several advantages mentioned may be realized in the same machine.

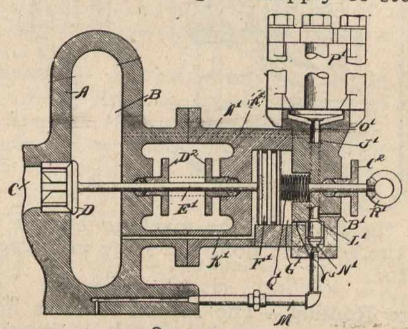
Gas Engine.—Charles J. Moody and Victor E. Moody.—804,332.—This engine is intended to combine within itself compactness and perfection of operation without sacrifice of power, and at the same time simplicity of construction and arrangement. The engine is intended to dispense with a multiplicity of cylinders and a duplication of piston-rods,



804,332.

and at the same time provide means for preventing a dead-centre. Another object is to bring the driven shaft in close proximity to the motor-cylinder and to provide for a rotation of the driven shaft by an oscillating movement of the pistons; also to dispense with the multiplicity of intake and exhaust ports by the arrangement of a series of valves for permitting the several ports to act alternately for the purpose of intake and exhaustion. It consists of a drum-cylinder, inwardly-extending abutments dividing the cylinder into chambers, a piston provided with blades extending to the chambers, a rocking or oscillating shaft on which the piston is mounted, a main rotating shaft and a connection between the rocking or oscillating shaft for transforming the rocking or oscillating movement into a rotary movement, supply and exhaust passages leading to the cylinder-chambers, valves controlling the supply and exhaust passages having valve-stems inwardly projecting toward the oscillating shaft, rocking arms pivoted between the valves adapted to alternately actuate companion valves, a short stud shaft rotatably mounted within the end of the oscillating shaft, and provided with a cam adapted to move the rocking arms which actuate the valves controlling the supply and exhaust passages.

Steam Turbines.—Charles G. Y. King.—804,413.—The purpose is to provide a construction of valve-controlling mechanism for turbines wherein the proper operation of the valves is indicated at a point outside the valve-casing. A further object of the invention is to provide a construction of valve mechanism for turbines which is simple and efficient, wherein each valve controlling the supply of steam is effici-

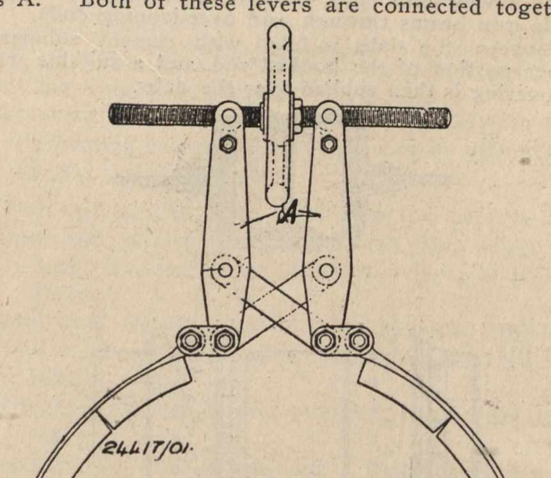


804,413.

ently balanced and has connected therewith an indicator extending to a point outside of the valve-casing to indicate when the valve is operating properly. It consists of a plurality of entirely-inclosed individual valves which have an open and a closed position, but no intermediate, for controlling the passage of motive fluid to the turbine, a casing which is common to the valves, and contains a chamber that supplies the ports controlled by the valves, actuators for the valves which are contained in the chest, and are hidden from view, controlling devices for the actuators located external to the valve-casing, which do not indicate the position of the valves and actuators, and means connected to move with each of the valves and its actuator to indicate whether the valve is open or closed.

GREAT BRITAIN.

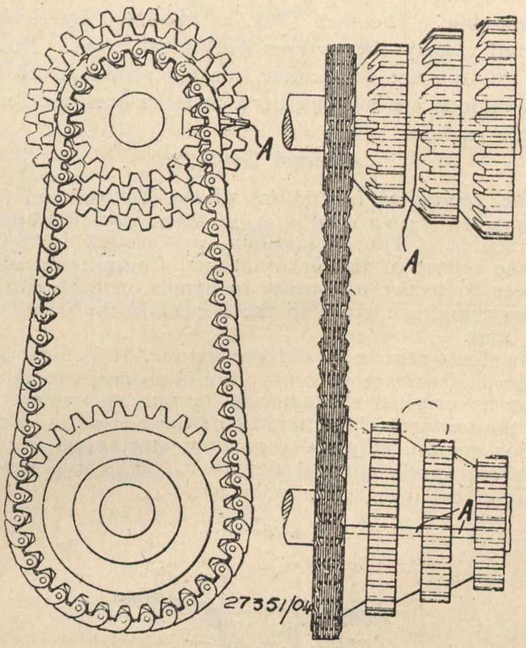
Brake Mechanism of Winches.—Lobnitz.—24,417.—The ends of the brake band are connected to the ends of two levers A. Both of these levers are connected together at



24,417.

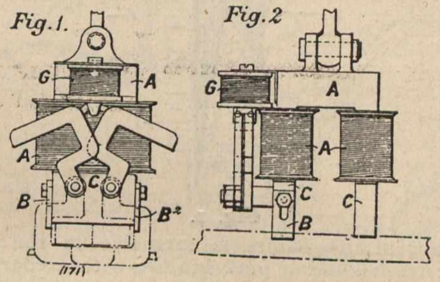
the bottom by two cross links, and at the top by a screwed spindle, so that on turning the screwed spindle the brake is quickly applied.

Stepped Cone Sprocket Wheels or Pulleys for Driving Chains—Westinghouse Brake Co., Limited. (Morse Chain Co.)—27,351.—The steps of the sprocket wheel are connected by intermediate frusto-conical surfaces provided with projections A for engaging the links of the chain, so as to keep the chain moving as it passes from one step of the sprocket wheel to the next.



27,351.

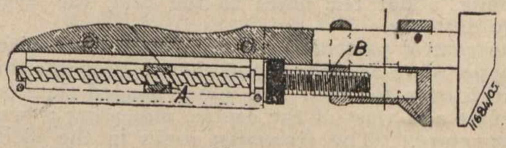
Safety Devices.—Steel, Peech and Tozer, Ltd., and H. E. Bowen, Sheffield.—171.—Safety devices to be used in combination with electro-magnets employed with cranes for raising and carrying rails, bars, ingots, and other metallic loads. From the crane is suspended a crosshead, and upon this is secured one or more electro-magnets, such as *A*, connected by line wires with the source of electricity, and generally arranged so that they can be operated by switches located in the crane attendant's cage. These magnets are provided with self-adjusting guide plates of gauges *B* and B^2, consisting of metal bars with elongated bolt-holes which are bolted to the outer ends of the lifting faces *C* of the magnets *A*, but so that they can move vertically on the bolts or studs. They are for the purpose of passing down a short distance on each side of the object or objects to be lifted,



171

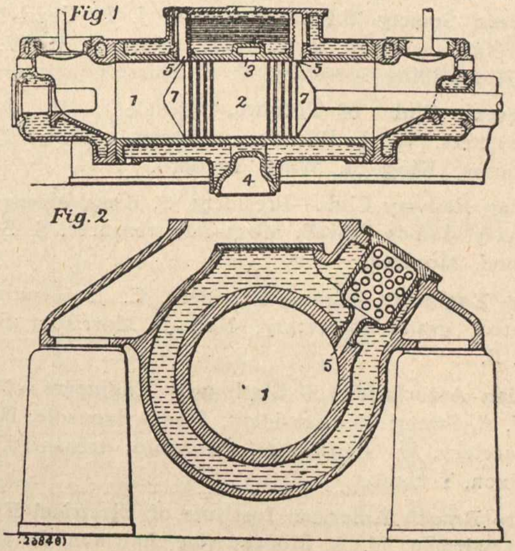
such, for example, as ingots, bars, or the one side rest upon the face of the load, they slide upwards until, as the magnets are moved laterally, they pass over the edge and drop back to their normal or lowest position, which indicate that the magnets are in position for lifting the load. The electro-magnets are constructed to retain a sufficiency of magnetic power after the main current is broken, to sustain the load for a short period, but sufficient to allow a number of pairs of safety claws sustained out of action by means of a small electro-magnet *G*, which loses its magnetic power immediately the circuit with the main magnets is broken from any cause to turn upon their axes, and drop instantly into the supporting position under the load, as indicated in both figures before the main or lifting magnets lose their sustaining power.

Wrenches.—Ellis and Batley.—11,684.—The slidable jaw is operated by an archimedean screw operated by a sliding member *A*, and the roughened collar, which is rigidly secured to stem *B*, is used for fine adjustments of the slidable jaw.



11,684.

Internal-Combustion Engines.—Mather and Platt, Limited, and A. E. L. Chorlton, Salford.—23,843.—Improvements in and relating to internal-combustion engines especially applicable to engines of the two-cycle type. It is well known that in engines as at present constructed, especially when of large size and working with combustible gases of high calorific value, difficulties occur owing to pre-ignitions in the combustion-cylinder during the compression stroke, and the object of the present invention is to obviate such difficulties by mixing with the combustible gases a proportion of inert gas in the cylinder itself. The combustion cylinder 1, in which moves the piston 2, has its exhaust ports 3, which communicate with the exhaust exit 4, situated at the middle. Opening into the cylinder 1 are two ports 5, one towards either end, which, when both are left open by the piston 2 at mid-stroke in the course of its travel, as shown in Fig. 1, place the two ends of the cylinder 1 in communication through the by-pass and cooling arrangement. This cooling arrangement may consist of pipes through which the gases



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pass, surrounded by water either in communication with the general water-cooling arrangements of the engine, or separately supplied, and may be conveniently arranged on the top of the cylinder, as shown in Fig. 1, or towards the side, as in Fig. 2; or the by-pass and cooling arrangement may obviously be separate from the cylinder, but connected therewith by pipes opening from the ports 5. The ends 7 of the piston 2 are inclined or curved in such manner as to deflect the products of combustion escaping from either port 5 into the middle of the charge in the cylinder 1. In the position shown in Fig. 1, the piston 2 is at mid-stroke supposed moving towards the left hand, in which case, the ports 5 both being open, the gaseous products of combustion from the last explosion in the right-hand end of cylinder 1 will escape through the cooling arrangement, wherein their temperature is reduced, into the charge of mixed combustible gas and air in the left-hand end of the cylinder 1, thus reducing the activity of the combustible gas and at the same time increasing the degree of compression of the charge for the next explosion without the expenditure of additional power. As the piston 2 moves further toward the left, it closes the port 5, and later on opens the port 3 to the exhaust. On the return stroke towards the right after the next explosion, the piston 2 after closing the port 3, will again open 5, and the products of combustion will then pass from the left-hand end of the cylinder 1 to the right-hand end.

HORSE-POWER AND MAN-POWER.

The measurement of a horse's power of work, first ascertained by Watt, the inventor of the steam engine, was founded upon the basis that the average brewery horse was capable of doing work equal to that required to raise 330 pounds of weight 100 feet in one minute, or 33,000 pounds one foot in one minute. This estimate, however, was for one minute; it would not be possible for a horse to perform this amount of work continuously for eight consecutive hours. One horse could exhaust twelve men in a single day, for where a strong man could perhaps pull half of 330 pounds to a height of 100 feet in two minutes, he probably could not repeat the operation more than a few times. A man's power is about one-tenth of a horse's power. That is, where a horse could pull 330 pounds to a height of 100 feet, one minute, and then slack up and repeat the operation, for eight hours, thus pulling four hours, and slacking up four hours, it would require ten strong men to perform the same amount in that length of time. When man put horses to work the gain in labor for the world was thus ten-fold. Multiply this by steam-power, water-power, air-power, and above all, electric power, and one has a problem in mechanical progression.—"Popular Mechanics."

ENGINEERING SOCIETIES.

Canadian Society of Civil Engineers.—President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod, rooms 877, Dorchester St., Montreal. Annual meeting will be held in Toronto during the fourth week in January, 1906.

Canadian Mining Institute.—President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Land, Victoria, B. C.; treasurer, J. Stevenson Brown, Montreal.

Engineers' Society S.P.S.—President, J. P. Charlebois; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Engineers' Club of Toronto.—President, R. F. Tate; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King St. West, Toronto.

Canadian Railway Club.—President, S. King, Montreal; secretary, James Powell, Montreal; treasurer, S. S. Underwood, Montreal.

Marine Engineers.—Grand President, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N. B.

Canadian Association of Stationary Engineers.—President, W. A. Sweet; vice-president, Joseph Ironside, Hamilton; secretary, D. Outhwaite, Toronto; treasurer, A. M. Dixon, Toronto.

Toronto Branch American Institute of Electrical Engineers.—Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Canadian Electrical Association.—President, A. A. Wright; first vice-president, R. G. Black; second vice-president, John Murphy; secretary-treasurer, C. H. Mortimer.

CANADIAN ASSOCIATION STATIONARY ENGINEERS.

Toronto, No. 1.

At the monthly open meeting on Wednesday evening, December 20th, Mr. James Milne, of the Underfeed Stoker Co., Limited, Toronto, gave a very interesting and instructive address, illustrated by black board sketches and mathematical demonstrations, on "Water Required for Condensing Purposes: Cost of Heating by Electricity." Mr. Milne dealt very comprehensively with his subject, dealing with the question of steam and electricity as used for power and heating purposes quite extensively.

The meeting was well attended, and it was manifest from the attention given the speaker that the subject was fully appreciated.

ENGINEERS' CLUB OF TORONTO.

Lecture on "Cobalt."

(Reported by our Special Correspondent, P. W. B.)

On Thursday evening, December 14th, Prof. Willett G. Miller, Provincial Geologist for Ontario, lectured before the Engineers' Club of Toronto on "Cobalt." The discourse was illustrated with lantern slides, showing the geology and configuration of the Temiscaming District, together with interesting pictures of mining scenes and incidents in the newly-opened region.

The discovery of this district as a mining section was chiefly due to the location chosen for a new railroad. Had the Engineers chosen the route first contemplated, the mineral wealth would doubtless have remained undiscovered for years. The district had been "lumbered" a few years before the advent of the railroad, and during the operations a slide was so placed that the logs tore into the decomposed ore at the surface of a large vein. At that time, no thought of its commercial value was entertained. In 1903, however, a railroad construction gang, attracted by the pink color of the cobalt bloom, conceived the idea that the ore bed exposed might be of economic value, and drew the attention of the Bureau of Mines to the interesting find. Prof. Miller—the lecturer—examined several samples and realized the importance of the discovery. A geological survey was made, therefore, and the mining possibilities at once made known to the public. The map (Fig. 2) exhibited by Prof. Miller, indicated clearly the various geological areas. In one respect this district is peculiar, for the strata found in other cobalt regions are missing here, and the ores are found very near the surface.

General Geology.

The geological formations of the district and their distribution are shown on Fig. 1, which is copied from map by Prof. Miller. The formations are named in accordance with the report of the International Committee, which met last year to secure unformity in names on both sides of the boundary, and are given in the legend in the order of age—oldest first.

The Keewatin is an old greenstone. It is most probably composed of surface volcanics, but is so much metamorphosed that its original character is hard to determine. It exhibits the textures characteristic of the Keewatin in the Lake Superior region, ellipsoidal parting, stretching, etc., and is probably properly correlated with it. It is well mineralized with arsenical iron and copper pyrite.

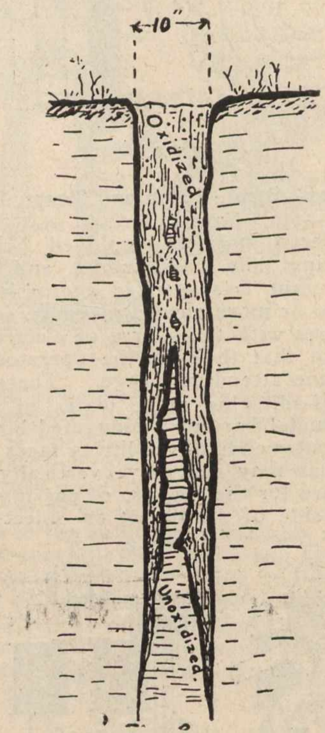

Fig. 1.

The Laurentian granite is intrusive in the Keewatin. It is a very fresh looking pink granite with a coarse texture, appearing to be the same as the coarse granites which are seen to the southwest in the Temagami district.

The Lower Huronian is the oldest sedimentary rock found in the district. It contains pebbles of what appear to be still older sediments, but these older formations are nowhere identified in place as yet. The Lower Huronian is extremely variable in its lower horizons, indicating that the conditions of its deposition were very irregular. It is apparent to one who has travelled over the country at all thoroughly that it was deposited in the irregular depressions of a rugged surface; exactly the condition which would make its lower horizon vary from place to place. We find a coarse conglomerate at the base in one section, and a mile or so away an even grained grey quartzite occupying that position. On the south end of the property of the Nipissing Mining Company (No. 11 on map), and at the Temiscaming Cobalt mine (No. 18), we find exactly the same order of succession. There is a coarse conglomerate at the base grading up into grey quartzite, and then a well banded slate with a second conglomerate above that, and finally, above the second conglomerate, an unknown thickness of fine grained grey or red banded slate. On the Quebec side of Temiscaming, about ten miles to the east, the succession is entirely different.

In the central part of the district only the horizons below the upper slate are found, and show a probable thickness of not much over 300 feet. The upper banded slate occupies the area east and west of the centre, indicating a broad anticlinal structure. The Huronian rocks in the vicinity of the ore deposits are either horizontal or dip at low angles. About six miles north of Haileybury they become steeply inclined, in places being nearly on edge.

The Middle Huronian is a yellowish grey feldspathic quartzite of coarse texture; an arkose. It occurs to the east and south of that part of the district shown on the map, and forms the shore of Lake Temiscaming. It is determined by Prof. Miller to be uncomformably above the Lower Huronian.

The Diabase.

These large intrusive masses vary from diorite to gabbro and diabase in composition. The rock is usually a diabase, and is so called in the legend on the map. Its age is indeterminate; it can only be said that it is earlier than the Niagara limestone, and later than the Middle Huronian. From analogy with the Lake Superior country, Prof. Miller states that it is probably Keweenawan.

The Niagara limestone occurs to the north and east of the district, overlying all other rocks. This formation is apparently later than the ore bodies, and so is of no interest in relation to them.

veins composed of single sheets of solid silver are also extensively found. These very rich ores are found only in spots, but as a whole the ore shows up very well. Carloads of 18 and 20 tons have, in numbers of cases, realized about $50,000.

The product of the first quarter year, ending March 31st, 1905, during which shipments were made, was 354.05 tons of ore valued at $293,552; an average of $829 a ton. The average percentage of the metals in the ore was as follows:

Silver	4.802%
Cobalt	8.264%
Nickel	4.739%
Arsenic	34.606%

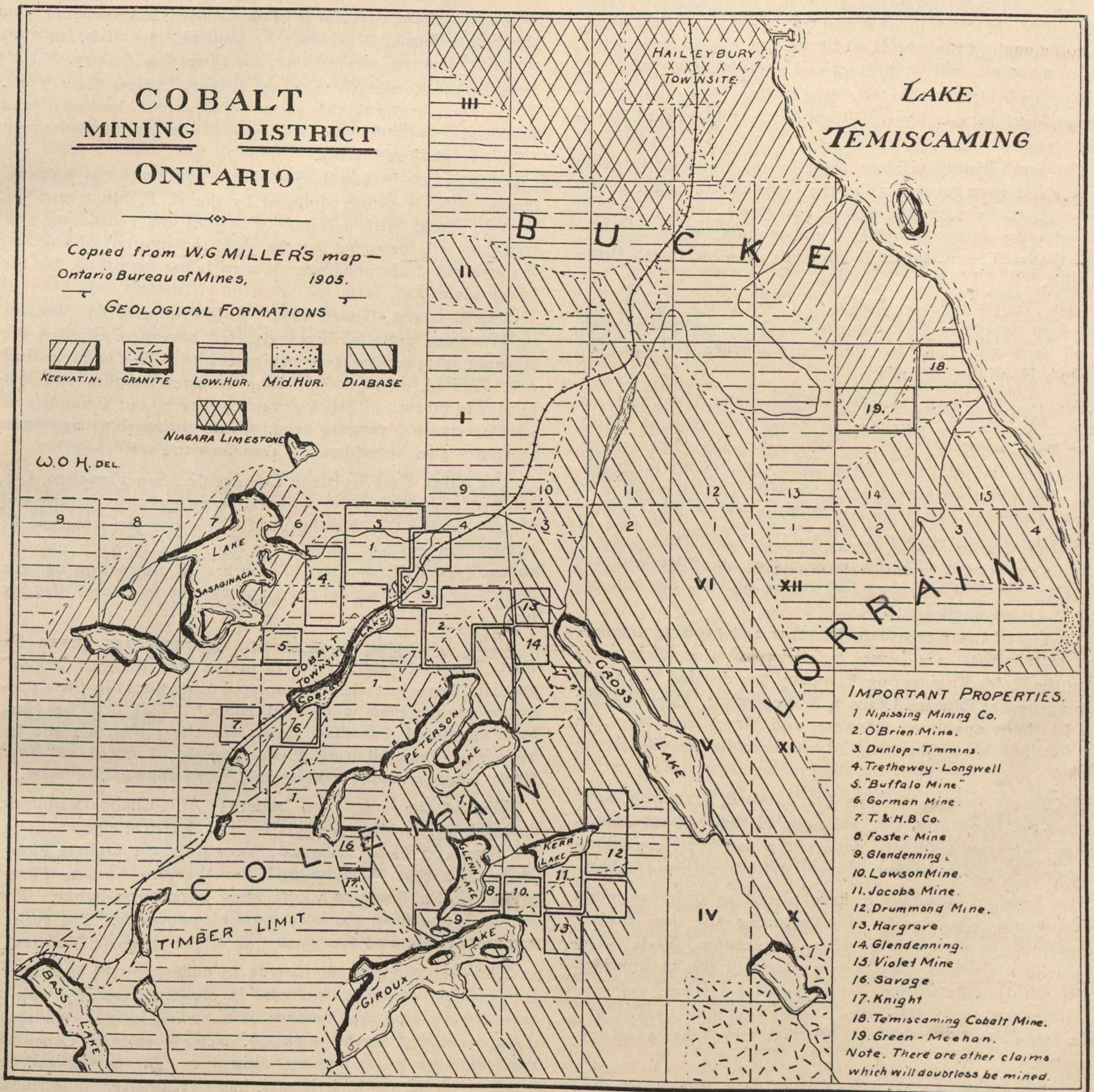

Fig. 2.

Glacial drift is present over all the area, and constitutes a formidable obstacle in prospecting.

The ore bodies or veins almost without exception lie in fissures.

Up to the present time the mining of the ore has been conducted by primitive methods, since all the workings are shallow, and with two or three exceptions, are worked with hand drills. The removal of waste rock is facilitated by the presence of joints not over 3 or 4 feet from the vein, which furnish admirable backing to brake to in blasting. Power plants are being erected by most of the larger producers.

The richness of the ores is phenomenal. It is quite common to find ten-inch veins largely composed of native silver, parts of which can be broken up with some difficulty into pieces small enough to bag; and in some parts half-inch

During the second quarter, from March 31st, to June 30th, 1905, the shipments were 537 tons, valued at $394,552, an average of $734 a ton. The average percentage of the metal in the ore for this quarter was:

Silver	4.158%
Cobalt	6.890%
Nickel	3.091%
Arsenic	30.912%

Cobalt is used chiefly as a coloring matter, especially in the manufacture of blue glass. It sells for about $3 per pound.

At the invitation of the club, a number of delegates to the Mining Conference then being held in Toronto, were present to hear Prof. Miller's lecture, and many were the expressions of appreciation.

INDUSTRIAL NOTES.

The London Machine Tool Co. have ordered from the Smart-Turner Machine Co., Limited, Hamilton, an automatic feed pump and receiver.

The Robb Engineering Company will have their quarters in the handsome suite of offices occupied by Watson Jack & Co. in the Bell Telephone Building, corner of Notre Dame and St. John Streets.

The Smart-Turner Machine Co., Limited, Hamilton, have supplied the Port Hope Electric Light & Power Co. with a standard duplex pump.

The wet machine room, grinding room and tempering building of the Spanish Pulp and Paper Co., Espanola, Ont., are to be equipped by the B. F. Sturtevant Co., Boston, Mass., with a complete blower, heating and ventilating system.

The Amherst Foundry Co. have ordered from the Smart-Turner Machine Co., Limited, Hamilton, a single beam travelling crane.

The first block of pig iron made by the electrical smelting process has been turned out at the experimental plant at the Sault. If this experiment proves successful Ontario will be started on a career of mineral and manufacturing development that will soon place this Province on a level with Pennsylvania.

The Wilson's Scale Works, Toronto, have recently installed an automatic feed pump and receiver, together with an oil separator, built by The Smart-Turner Machine Co., Limited, Hamilton, Canada.

Mr. C. S. Powell, general agent of the Westinghouse Electric & Mfg. Co., who has for some time occuped offices at 11 Pine St., New York, has removed to the offices of the company on the 19th floor of the Trinity Building, 111 Broadway. The Westinghouse Electric & Mfg. Co., in addition to their offices in the Hanover Building at 11 Pine Street, occupy the entire 19th floor of the Trinity Building.

The Jenckes Machine Co. have placed an order with the Smart-Turner Machine Co., Limited, Hamilton, for one of their standard duplex pumps.

Owing to the increase of business and growing importance of Montreal as a centre for distribution of their products, the Robb Engineering Company has decided to change their agency at Montreal into a branch office. Mr. Watson Jack has been appointed manager, and Mr. Alister MacLean will continue in the capacity of engineer for the Montreal district.

The Smart-Turner Machine Co., Limited, Hamilton, have supplied the Beck Mfg. Co., with one of their oil separators, together with an automatic feed pump and receiver; pump being of the outside packed plunger pattern with pot valves.

The Newport Mining Co. have placed an order with the Westinghouse Electric & Manufacturing Co. for electric locomotives, to equip their mines at Ironton, Mich. The equipment of the necessary power plant will also be provided by the Westinghouse Co.: consisting of a 150 kw., 250 volt generator, direct connected to a Corliss engine of 130 R.P.M., and a three-panel switchboard, together with other auxiliary apparatus.

The Westinghouse Machine Co., of East Pittsburgh, Pa., is supplying the Missouri River Power Transmission Company with Westinghouse-Parsons turbines. The initial equipment consists of two units of 2,000 kw. capacity each. They will be capable of delivering continuous overload of at least 50 per cent. condensing, or full load without the assistance of a condenser. The generators will be of the revolving field type, completely enclosed. They will operate at 1,200 r.p.m., and deliver 60 cycle, three-phase current at 2,400 volts.

Among the recent shipments made by the Westinghouse Electric & Mfg. Co., are the following: A 1.200 kw. alternating current generator, and three 500 kw. oil transformers, to the Hawaiian Electric Company, Honolulu. During the month of October the shipments of electrical apparatus from this factory amounted to approximately 17,000,000 lbs., consisting of over 5,000 individual shipments.

It is the intention of the Dominion Iron & Steel Co. to add two Bessemer converters to its plant this winter. This will increase the capacity from 25 to 50 per cent.

The peat works at Fort Frances, Ont., are now in full operation. A large amount of electrical machinery has been installed.

The Dominion Coal Co. has decided to operate its mines by electricity, and for this purpose will install the largest colliery electrical plant in America.

The St. Denis Boulevard car barns of the Montreal Street R.R. Co., are being equipped by the B. F. Sturtevant Co., Boston, Mass., with two complete heating apparatus and an induced draft apparatus for the boiler plant.

Messrs. John Bertram & Sons, Limited, have ordered from the Smart-Turner Machine Co., Limited, Hamilton, an automatic feed pump and receiver, for their new factory.

Alberger Condenser Co., 95 Liberty Street, New York, N.Y., have acquired the entire Wainwright business, and hereinafter will be the sole manufacturers of the many "Wainwright" specialties.

The 30 stall roundhouse of the Intercolonial Railway, Truro, N.S., is being equipped by the B. F. Sturtevant Co., Boston, Mass., with a complete heating and ventilating system especially designed for the rapid thawing out of engines. An induced draft apparatus is also being furnished for the boiler plant.

The Western Canada Flour Mills Company will operate its Winnipeg mills by electricity, and have just awarded the contract for the necessary equipment to Allis-Chalmers-Bullock, Limited, of Montreal. The contract includes two synchronous motors of 500 h.p. capacity each, and a number of smaller motors, ranging from 5 h.p. to 200 h.p., aggregate 750 h.p.; also switchboards, transformers, etc.

The Santa Cruz Portland Cement Co., San Francisco, Cal., has just placed an order with the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., for one 800 h.p. type C. motor; ten 250 h.p.; fifteen 150 h.p.; one 75 h.p.; and one 30 h.p. type CCL motors. These are all alternating current motors of the induction type, and aggregate a total of 5,655 h.p.

The Economical Supply Co., Limited., 173 Queen St. East, Toronto, manufacturers of the well known "Canada" graphite, have just about completed alterations to their premises, giving them additional room. This firm has just been appointed Canadian agents for the products made by the New York Belting & Packing Co., Limited, of New York, whose name is a household word among Engineers.

Within the past two months Allis-Chalmers-Bullock, Limited, have made contracts for the electrical equipment of the Keewatin Flour Mills Co., Keewatin; the Ogilvie Flour Mills Co., Fort William, and the Western Canada Flour Mills Co., St. Boniface, aggregating 4,000 horse-power. The motors range from 500 horse-power downwards. The entire equipments are under construction at the shops in Montreal.

The first company in Canada to undertake the manufacture of steel cars was organized in Montreal recently with a view of supplying the demands of Canadian railways for this class of rolling stock. Chicago, New York, and Canadian capitalists are promoting the enterprise. The capital will be $500,000, all of which, it is said, has already been subscribed. A large plant will be erected in Montreal West next spring, and it is expected that four hundred men will be employed.

The Northumberland-Durham Power Co., Limited, is the name of a new company, recently organized, with an authorized capital of $750,000. This company intends to develop the Healy Falls power for electrical purposes, at Campbellford, Colborne, Brighton, Cobourg, Port Hope and other places in the counties of Northumberland and Durham. Among the provisional directors are the following: W. J. Crossen, president of the Crossen Car Co., Cobourg; H. T. Bush, Port Hope; Samuel Nesbitt, Brighton; Robt. A. Mulholland, Port Hope. Mr. J. A. Culverwell, the organizer of this company, is also managing director of the Central Ontario Power Co., Limited, of Peterboro', which owns Burleigh Falls, contiguous to that city.

MARINE NEWS.

The foreign engineers on the President's consulting board all favor a sea level canal for Panama.

It is said that Mackenzie & Mann, railway promoters, contemplate as one of the links in their scheme for a trans-continental line the placing on Lake Superior of a fleet of ice-breaking car ferries.

The board of consulting engineers of the Isthmian Canal Commission has decided to substitute Brussels for Paris as the meeting place of the foreign members in January.

The Canadian Canals Corporation will seek to have a bill enacted by the Canadian Parliament this winter authorizing the construction of a canal and marine railway route for ships across Canadian territory from Georgian Bay to Lake Ontario.

A number of well-known navigation men of Hamilton, says the "Herald," are forming a new company which will operate a line of boats between that city and Montreal next season. The new line will have three boats, and will form an opposition to the Richelieu and Ontario Navigation Company, which makes Hamilton a port for its steamers.

The lighthouse on the False Duck Island, near Kingston, Ontario, recently destroyed by fire, was the oldest lighthouse in the country. On March 25th, 1828, when Sir John Colborne was governor of Upper Canada, the legislature of the province passed an Act granting £10,000 for erecting "a good and sufficient lighthouse" for the safety and convenience of navigation on Lake Ontario.

The largest, finest equipped and fastest steam schooner ever planned for trade on the Pacific Coast will soon be built for the Seattle-San Francisco run. The company is at present engaged in the lumber trade and is one of the several concerns represented by L. H. Gray & Company. The vessel will carry 1,000,000 feet of lumber when in commission and have accommodations for 50 first-class and 40 steerage passengers.

RAILWAY NOTES.

It is announced that the Brantford Street Railway will change hands. The purchasers are unknown. Big improvements and extensions are contemplated.

The Grand Trunk Railway intends putting up a new station on the north side of St. James Street, Montreal, and will elevate its tracks, thus doing away with all the level crossings. The estimated cost is six million dollars.

Mr. Brennan, Clerk of the Peace for the county of Lincoln, has received from Aubrey White, Deputy Minister of Crown Lands, plans and profiles for the extension of the Hamilton, Grimsby and Beamsville Electric Railway to St. Catharines.

The earnings of the Toronto Street Railway Co. continue to increase rapidly. The total receipts for November reached $220,893, as against $198,150 for November, 1904, an increase of $22,653. The city's percentage for last month will be almost $30,000.

The Canadian Northern Railway Company has ordered forty new locomotives, which may be increased to sixty, four hundred flat cars, one thousand box and stock cars, and several hundred passenger cars. This new equipment is for delivery during 1906, and if Canadian firms can meet the company's demands the orders may all be increased. An expenditure on equipment exceeding $2,000,000 is anticipated.

It is stated that the Grand Trunk Railway Co. have let the contract for the equipment of the Port Huron-Sarnia tunnel with electric power for the operation of trains. The contract involves the building of large power houses in Port Huron and Sarnia, and the total cost is said to be nearly $700,000. The third rail system and powerful electric locomotives will be used. The adoption of electricity will remove all danger from gas in the tunnel.

The net earnings of the 113 miles of the Temiskaming Railway from North Bay to New Liskeard for the seven months ending with October totalled $84,000, or equal to 3 per cent. on the capital invested. That is a capital showing, and there is every reason to expect that the record so far made will be maintained. The recently discovered mineral wealth of New Ontario, to which the success of the road is largely due, will, there is every reason to believe, prove a permanent source of wealth.

MINING MATTERS.

It is reported that the Rainy River District has the richest gold deposits in the world.

The Moose Mountain Iron Ore desposits have passed into the hands of Mackenzie & Mann.

The iron mining properties on Vancouver Island held by Messrs. Bentley & McGregor have been sold to a company of United States and English capitalists.

A report from the Assistant Commissioner at White Horse states that a rich vein of gold ore a mile and a half long has been struck in the Montana mines. It is said this is worth $12,000,000.

Coal abounds in almost inexhaustible quantities in the country some distance north of the Bulkley valley, which is watered by several tributaries of the Skeena River, according to a member of the J. H. Gray survey party, who returned from the north recently.

The directors of Cariboo Consolidated, Limited, have convened an extraordinary general meeting of the company for the purpose of submitting resolutions in favor of increasing the capital of the company to £220,000 by the creation of 200,000 preference shares of 2s. each.

In the report of the Bureau of Mines, part second, which has just been published, Mr. Willet G. Miller, Government geologist, embodied the results of his recent surveying trip in the cobalt and silver mining fields of the Lake Temiskaming region. The report is an exhaustive one, containing some 60 pages of very interesting information, profusely illustrated from photographs taken during the trip.

LIGHT, HEAT, POWER, ETC.

The Montreal Light, Heat & Power Company, Montreal, will erect a building for their head office. The price paid for the land is said to be $50,000.

The Shawinigan Falls Power Company is figuring on running a line from Three Rivers to Victoriaville and from thence to Thetford Mines and Black Lake. They will furnish power for the working of the mines and also supply light and power for the various villages in Megantic.

The conflicting power interests on the Ottawa and Hull side of the Ottawa River have, it is stated, agreed to jointly construct a dam for the development of more power. Each side will bear one-half of the cost and the power is to be equally divided, while the litigation will be dropped. The interests, however, desire that the Government go on with its proposal to construct dams to hold back the water in the Upper Ottawa.

PERSONAL

W. C. Mitchell, general superintendent of the British Westinghouse Electric & Mfg. Co., Ltd. (late of The Illinois Steel Co., Chicago, and the Nicopol Mariopol Mining and Metallurgical Co., Mariopol, Russia), has resigned his position to associate himself with Charles P. Markham, Chesterfield, Derbyshire, England.

We understand that Mr. H. H. Henshaw has resigned from the directorate and general managership of the Allis-Chalmers-Bullock, Limited. Prior to accepting the general managership of the company referred to, in June last. Mr. Henshaw was secretary-treasurer of the Montreal Light, Heat & Power Co.

Mr. Albert J. Pitkin, president of the American Locomotive Co., who died recently at his home on Riverside Drive, New York, was well known in Montreal, having succeeded the late Samuel R. Callaway as the executive head of the American Locomotive Co., and of its Canadian branch, the Locomotive & Machine Co. of Montreal.

Mr. Charles A. Olson, who for several years has been superintendent of the flanged fitting department of Crane Co., Chicago, has been promoted to the newly created position of general superintendent of that company. Mr. Olson was formerly superintendent of the St. Petersburg, Russia, plant of the Societo Anonymo Westinghouse.

MUNICIPAL WORKS, ETC.

Dundas Council have decided to install a filtering plant and make improvement to the reservoir.

The town council of Saskatoon, Sask., will install a waterworks system at a cost of about $125,000.

The ratepayers of Owen Sound, Ontario, have voted favorably on a by-law to expend $12,000 to erect a bridge on Poulett Street.

Raymond, Alberta, is installing a water supply tank of 10,000 gallons capacity, operated by an air motor pumper. The outfit is being supplied by the Devlin-Tyrrell Co., of Winnipeg.

The people of Kingston will vote on a by-law in January to exempt the Canadian Locomotive Works from taxes for ten years. If the by-law carries the company agree to enlarge their works. The capacity now is sixty engines per year.

Weston, Ontario, will continue municipal ownership for the electric light plant for some time at least. Recently the council rejected the offers of the Stark Telephone, Light & Power Company, of Toronto Junction, and the Southern Light & Power Company, of Erindale.

The Cartierville Electric Light & Power Company have secured a twenty-five year franchise for the lighting of the town of Bordeaux. The same company has also the contract for furnishing light and power to the town of St. Laurent, Que. Mr. Charles Brandeis, C.E., of Montreal, is the consulting engineer.

TELEGRAPH & TELEPHONE

The Home Telephone Company is negotiating with the city of Vancouver for the installation of a new automatic telephone system in that city. The company is installing a $1,000,000 plant in Portland and state that they are prepared to spend $1,000,000 in Vancouver if a satisfactory agreement can be arrived at.

With a view of showing the French Post Office the immense advantages which would result from the adoption in Paris of an automatic telephone system, which needs no girl operators, Mr. G. W. Lorimer, a young Canadian engineer, who is backed by powerful American capitalists, has fitted up an exchange in Paris, where for the last four months, the technical committee of the French Government telephone department has been closely investigating the system.

NEW INCORPORATIONS.

Dominion.—The Ontario Car Ferry Co., Montreal, $500,000; C. M. Hays, E. H. Fitzhugh, J. W. Loud, Montreal; A. G. Yates, W. T. Noonan, R. W. Davis, Rochester, N. Y.

The Berry Lubricator and Machine Co., Ottawa, $250,000; J. Walker, A. Wilson, Montreal; A. Berry, Shefford, Que.; E. A. Bleakney, W. Gamble, F. A. Heney, Ottawa.

The Carcross Syndicate, Toronto;, $150,000; J. C. Grace, C. W. Mitchell, W. Kelly, G. Tillie, W. F. McRae, Toronto.

The Jamaica Light and Power Co., Montreal, $250,000; J. Hutchison, C. J. Fleet, W. G. Brown, Montreal; G. M. Webster, H. Holgate, Westmount.

The Canadian Forty Mile Gold Dredging Co., Toronto, $600,000; J. S. Lowell, W. Bain, R. Gowans, E. W. McNeill, S. G. Crowell, W. F. Ralph, Toronto.

The Cambrian Mineral Co., Sudbury, Ont., $100,000; R. G. Leckie, J. E. Leckie, W. J. Montgomery, Sudbury; R. G. E. Leckie, London, Eng.; B. D. Gillies, Montreal.

The Miramichi Quarry Co., Montreal, $90,000; R. A. E. Greenshields, A. W. G. Macalister, W. J. Henderson, A. C. Calder, W. D. Garland, Montreal.

The Renaud Interlocking & Block System Co., Montreal, $250,000; L. A. Derome, J. Archambault, Alexander Dupuis, L. A. David, E. Renaud, R. Prefontaine, H. Dupuis, A. Dupuis, Montreal.

The Corrugated Steel Bar Co., of Canada, Montreal, $50,000; G. E. Drummond, T. J. Drummond, D. S. Walker, J. T. McCall, R. S. Lea, Montreal.

Canadian De-Tinning and Chemical Co., Montreal, $100,000; H. H. Wolff, J. Wolff, A. Pollack, A. Boker, H. J. Hague, Montreal.

Parker Foundry Co., Montreal, $25,000; J. Ballantyne, H. W. Glassford, Montreal; M. C. Rosenfeld, Cleveland, Ohio; W. J. White, A. W. P. Buchanan, Montreal.

Ontario.—Temagami Mining and Milling Co., Toronto, $40,000; C. L. Beckwith, L. O. Hedden, E. B. Hedden, W. E. Thatcher, J. B. Wilson, F. L. Luff, E. J. Meeker, H. F. R. Aymar, East Orange, N.J.; R. N. Brundage, F. F. Guild, T. W. Shaw, J. H. Meredith, Newark, N.J.

The Silver Five Mining Co., New Liskeard, $40,000; J. Mathews, W. McKnight, D. Stewart, W. H. Roebuck, J. Loudin, D. T. K. McEwen, E. P. Smith, New Liskeard, Ont.

The Standard Tin Works, Toronto, $40,000; T. H. Cook, R. MacKenzie, Sarnia, Ont.; J. A. McGolpin, W. F. Boddy, H. F. Budd, Toronto.

Temiscamingue Reduction Work, Cobalt, $166,000; P. Kirkegaard, Delora, Ont.; H. C. Hammond, G. Ritchie, N. B. Gash, C. L. Benedict, Toronto.

Toronto-Cobalt Mining Co., Toronto, $300,000; H. B. Wills, Z. Gallagher, Toronto; J. S. Humberstone, York, Ont.; W. Vandusen, Toronto Junction, Ont.; A. McMillan, Cobalt, Ont.

The Stephenson Belting Co., Toronto; $40,000; J. E. Stephenson, W. Stephenson, B. G. Stephenson, W. Gillespie, M. Stephenson, Toronto.

The Imperial Electric Motor Co., Toronto, $200,000; A. Dods, R. McKay, G. Grant, W. F. McIntosh, A. Elliot, A. E. Lyon, A. L. Bitzer, Toronto.

The Petrolia Gas Co., Petrolia, $40,000; W. C. Noxon, G. E. Noxon, C. Swabey, Toronto; J. W. McCutcheon, B. McCutcheon, Petrolia, Ont.

The Western Machine Co., Toronto, $40,000; G. McLachlan, W. T. Folliott, B. Thompson, J. D. Montgomery, R. A. Montgomery, Toronto.

Sovereign Cobalt Mining Co., Toronto, $200,000; W. L. Lefroy, P. J. M. Horrocks, F. J. Stanley, W. A. Smiley, N. L. Ramsay, Toronto.

The Rhodes Metallic Packing Co., Toronto, $40,000; J. M. Rhodes, J. S. Dawson, R. L. McAfee, L. R. Rhodes, M. A. Dawson, Toronto.

Manitoba.—The British North America Peat Fuel Co., Winnipeg, $1,000,000; D. Sinclair, W. F. Teetzel, W. H. Hastings, Winnipeg; D. H. Watson, Brandon, Man.; H. D. Bushnell, Chicago, Ill.

The Canada Paving and Construction Co., Winnipeg, $100,000; H. P. Pennock, W. R. Allan, H. Beliveau, R. Winkler, E. W. Roberts, Winnipeg, Man.

Railroad Patent Fuel Saving Device Co., Winnipeg, $80,000; H. Phillips, J. J. Brown, A. W. Morley, H. P. Davidson, H. H. Burrell, Winnipeg.